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US Army Corps of Engineers
New Orleans District

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REMOTE SENSING SURVEY AND EVALUATION OF THE AMERICAN PASS AND BLUE POINT CHUTE WEIRS, ATCHAFALAYA CHANNEL TRAINING PROJECT, LOUISIANA

Final Report

June 1989

COASTAL ENVIRONMENTS, INC.
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A remote sensing survey of two locales slated for weir construction along the lower portion of the Atchafalaya Main Channel was conducted. The primary instrument used was the magnetometer. Over 30 magnetic anomalies were located, most of which appear to be small, individual objects, possibly modern debris. Three anomalies in one of the areas, American Pass, fall adjacent to the preposed location of the weir. Exploratory diving failed to locate the sources of any of the anomalies. It is presumed that the sources are small or scattered objects, unlikely to be portions of shipwrecks.

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DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
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REPLY TO
ATTENTION OF:

April 27, 1989

Planning Division
Environmental Analysis Branch

To The Reader,

This cultural resources effort was designed, funded, and guided by the U.S. Army Corps of Engineers, New Orleans District as part of our cultural resources management program. This report represents the first phase in the cultural resources evaluation of channel training along the Atchafalaya Basin Main Channel. The report documents the remote sensing survey of the Blue Point Chute and American Pass Weirs as well as the subsequent evaluation of three magnetic anomalies in the project areas.

We concur with the Contractor's conclusion that no significant cultural resources will be affected by construction of the proposed weirs. Regarding the Contractor's recommendation that we should investigate a sample of the anomalies located in the main channel, we will give this idea full consideration as we progress in our cultural resource studies of the Atchafalaya Basin Main Channel.

Michael E. Stout
Technical Representative

Edwin A. Lyon
Authorized Representative
of the Contracting Officer

R. H. Schroeder, Jr.
Chief, Planning Division

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CHAPTER 1: INTRODUCTION

This report presents the results of remote sensing surveys and exploratory diving operations conducted at two locales in the lower Atchafalaya Basin in St. Martin and St. Mary Parishes, Louisiana. The two locations are Blue Point Chute, located at approximately River Mile 102 about 14 miles above Morgan City, and American Pass, located at River Mile 111, five miles above Morgan City (Figure 1). Construction of channel training weirs is slated at both of these areas as elements of the Channel Training program for the Atchafalaya Basin Floodway System. The purpose of the channel training is to stimulate the development of natural ridges, confining low to average flows to the immediately adjacent Atchafalaya Basin Main Channel. Rock weirs will be constructed at Blue Point Chute and American Pass to partially close these two waterways. In addition to the rock weirs, future construction activity will include dredging adjacent portions of the main channel of the Atchafalaya. Several shipwrecks are reported to have occurred in the vicinity of these two project areas and the present study was implemented to determine if shipwreck remains may exist which would be impacted by the proposed construction activities.

The Atchafalaya Basin is a large freshwater swamp area containing numerous rivers, streams, lakes and ponds. Transportation and commerce in this region has always depended largely upon watercraft. There is no doubt that aboriginal populations of the region depended upon dugout canoes in their travels through and across the area. Later in time, European craft such as bateaus, skiffs, luggers, and, eventually, steamboats plied the waters of the Atchafalaya Basin. Today the Atchafalaya River and the associated waterways that form the Atchafalaya Main Channel continue to be an important commercial transportation route and the smaller streams and lakes of the area are used extensively by fishermen, trappers and visitors. Over its period of use, untold numbers of watercraft have been lost in the Atchafalaya Basin. These watercraft are the objects of interest in this study.

The primary instrument used in the remote sensing survey was the proton precession magnetometer which detects the presence of ferrous metals. Of necessity, therefore, the objects of concern became those historic boat wrecks that contain sufficient quantities of iron to be detected by the magnetometer. This class of vessels includes, primarily, larger historic craft such as steamboats, luggers, etc. Smaller boats or those without iron elements certainly may exist as wrecks in the project areas; however, they would be undetectable with the remote sensing instruments used in this study. Details on the equipment, conduct and results of the study are provided in later sections of this report.

In conjunction with the magnetic survey, an assessment of the geological history and shipwreck potential of each of the project areas was made. This information provided a background against which the results of the magnetic survey could be interpreted. Interpretation of magnetic signatures relied, therefore, on the historical information available on vessel losses in each of the project areas and on the impacts which post-wreck, natural, as well as man-induced, activities may have had on wrecks in these areas. Identification and evaluations of these impacts were derived, in part, from assumptions about various effects that these forces would have on a wreck since actual accounts concerning post-wreck alterations in the region are rare. Interpretation of recorded magnetic signatures also drew upon the available literature on shipwreck magnetics. Each of these factors is fully discussed in the following chapters.

Relying on these interpretations, three magnetic anomalies in the American Pass project area were selected for examination. The diving operations conducted at American Pass are fully discussed in the body of this report.

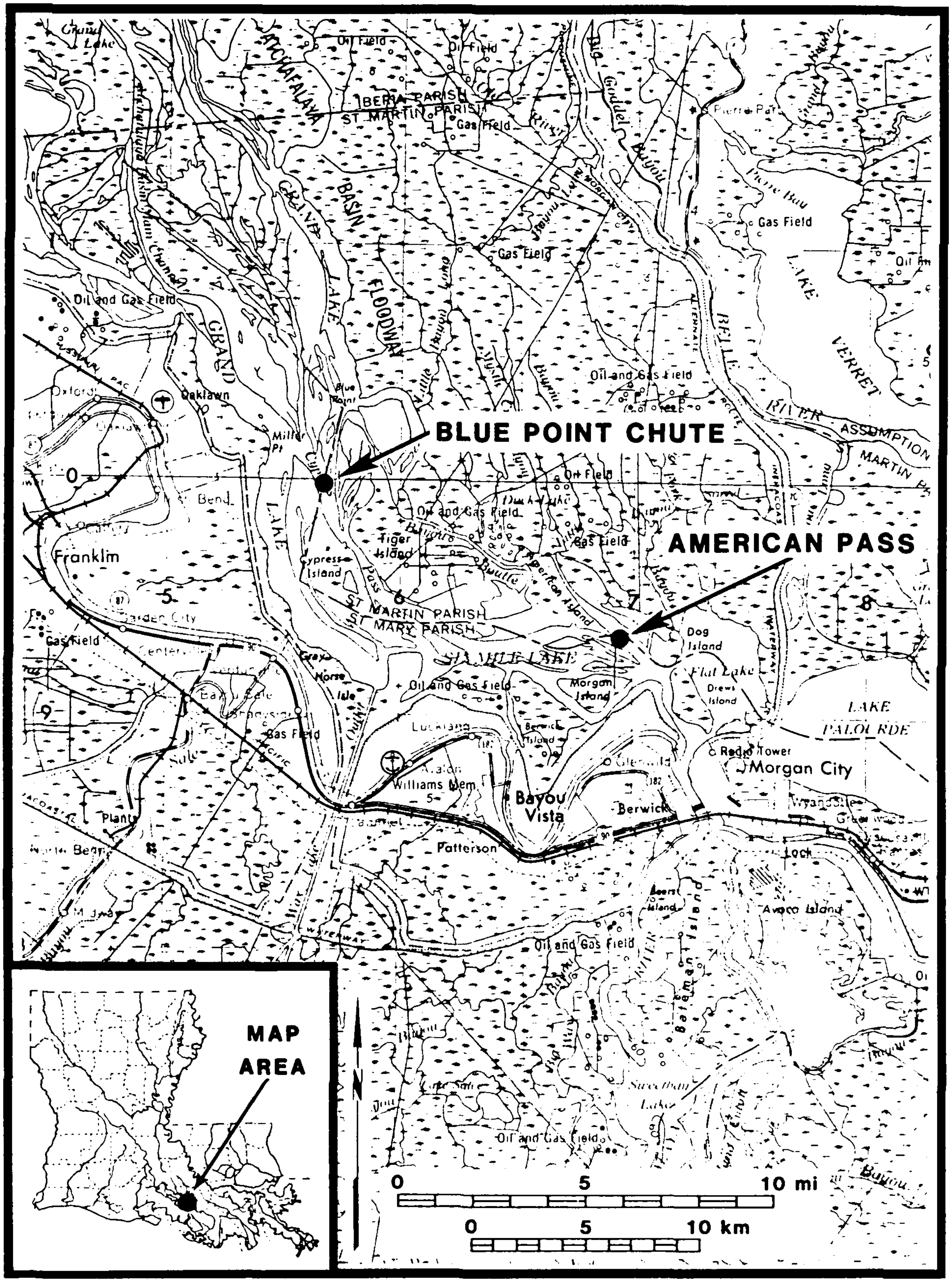

Figure 1. Locations of the Project Areas.

The data developed in this study are meant primarily to provide the New Orleans District, Corps of Engineers with information on the cultural resources potential of these two project areas. In addition, it is hoped, that the information presented here will serve as a contribution to the broader area of the District's overall management of cultural resources. This study is intended, also, to provide a useful contribution to the body of literature available on the use of magnetic survey in the search for boat wrecks.

Acknowledgements

The authors wish to acknowledge several people who helped bring this project to completion. Edwin Lyon served as Authorized Representative of the Contracting Officer for the New Orleans District, U.S. Army Corps of Engineers, and Michael Stout acted as Technical Representative. The field crew during the remote sensing survey consisted of Bill Flores and Shelby Duhe and the individuals involved in the diving were Thurston Hahn, Laura McMurray and Arthur Maxey. Curtis Latiolais drafted the figures for this report. All of these individuals are thanked for their efforts.

CHAPTER 2: NATURAL AND HISTORICAL SETTINGS

Geological History

The Blue Point Chute and American Pass project areas fall within the lower Atchafalaya Basin, the largest overflow swamp in North America. The basin is a large, shallow depression bounded by present and former Mississippi River courses. To the east are the present course of the Mississippi and the relict, Bayou Lafourche course. To the west is Bayou Teche, a relict course of the Mississippi River. The lower Atchafalaya Basin falls within the deltaic plain, a thick wedge of fluvial sediments formed as the Mississippi River shifted its course across this region over the past 8000 years or so. The developmental history of the deltaic plain has been well studied (e.g., Fisk 1952; Fisk and McFarlan 1955; Frazier 1967) and the geological and geomorphological processes responsible for the evolution of the Atchafalaya Basin are generally well known (see Smith et al. 1986). The recent history of the development of the lower Atchafalaya Basin is of concern in this study and is briefly discussed here.

The Atchafalaya Basin trends in a generally north to south direction, extending from above Krotz Springs, Louisiana, in the north to Morgan City, Louisiana, in the south. The basin consists almost entirely of swamps and numerous shallow lakes. Land surfaces in the region are flat with elevations generally less than 5 m. The present physiography of the Atchafalaya Basin is largely the result of events which have taken place in the last 2000 years (Smith et al. 1986:44) and, as will be discussed, significant changes have occurred just within the past 100 years. The upper, modern surface deposits of the Atchafalaya Basin are underlain by thick strata of sediments laid down by fluvial processes during the past 8000 to 10,000 years. These underlying deposits consist of two major units: a basal unit, knows as the substratum, and an overlying unit known as the topstratum (Smith et al. 1986:41). The substratum consists of coarse sands and gravels deposited during rising seas after the last Pleistocene glaciation, while the topstratum consists predominantly of sandy clay, silty clay and clay sediments formed in backswamp, lacustrine and lacustrine delta environments (Krinitzsky and Smith 1969; Krinitzsky 1970). The stratigraphic and lithologic evidence indicates that the basin was occupied by shallow lakes and backswamps throughout most of the Holocene (Smith et al. 1986:42).

As Smith et al. (1986) discuss, the current physiography of the Atchafalaya Basin is the product of three major events that have occurred in the past 2000 years. The first of these was the closure of the southeastern end of Atchafalaya Basin by the Lafourche deltaic system. This happened about 1500 to 2000 years ago when the Little Bayou Black-Bayou du Large distributary course intersected the Mississippi-Teche course (Bayou Black) near the present-day city of Houma. The natural levees of these distributaries formed a dam which impounded the water coming into the basin from the north. Over a period of several hundred years, an extensive shallow, lake system was created in the southern portion of the basin. Eventually, the impounded waters topped and cut through the natural levees of the Teche course at the locations of the present communities of Patterson and Morgan City.

During its early history, the southern system of lakes in the Atchafalaya Basin was quite extensive. Relying on archaeological site data and on historical cartographic sources, Smith et al. (1986:45) suggest that the maximum up-basin extent of the prehistoric lake boundary was at Upper Grand River, about 45 mi above Morgan City. Lakes continued to cover much of the lower portion of the basin in the nineteenth century. Figure 2 presents a detail from an 1829 map which depicts the amount of open water in the lower basin at that time. Figure 3 presents a portion of an 1884 map of the area showing almost the same amount of open water, suggesting little loss of open-water habitat in the lower basin during

Figure 2. Detail of 1829 map showing lake conditions in the lower Atchafalaya Basin (Source: Swift 1829).

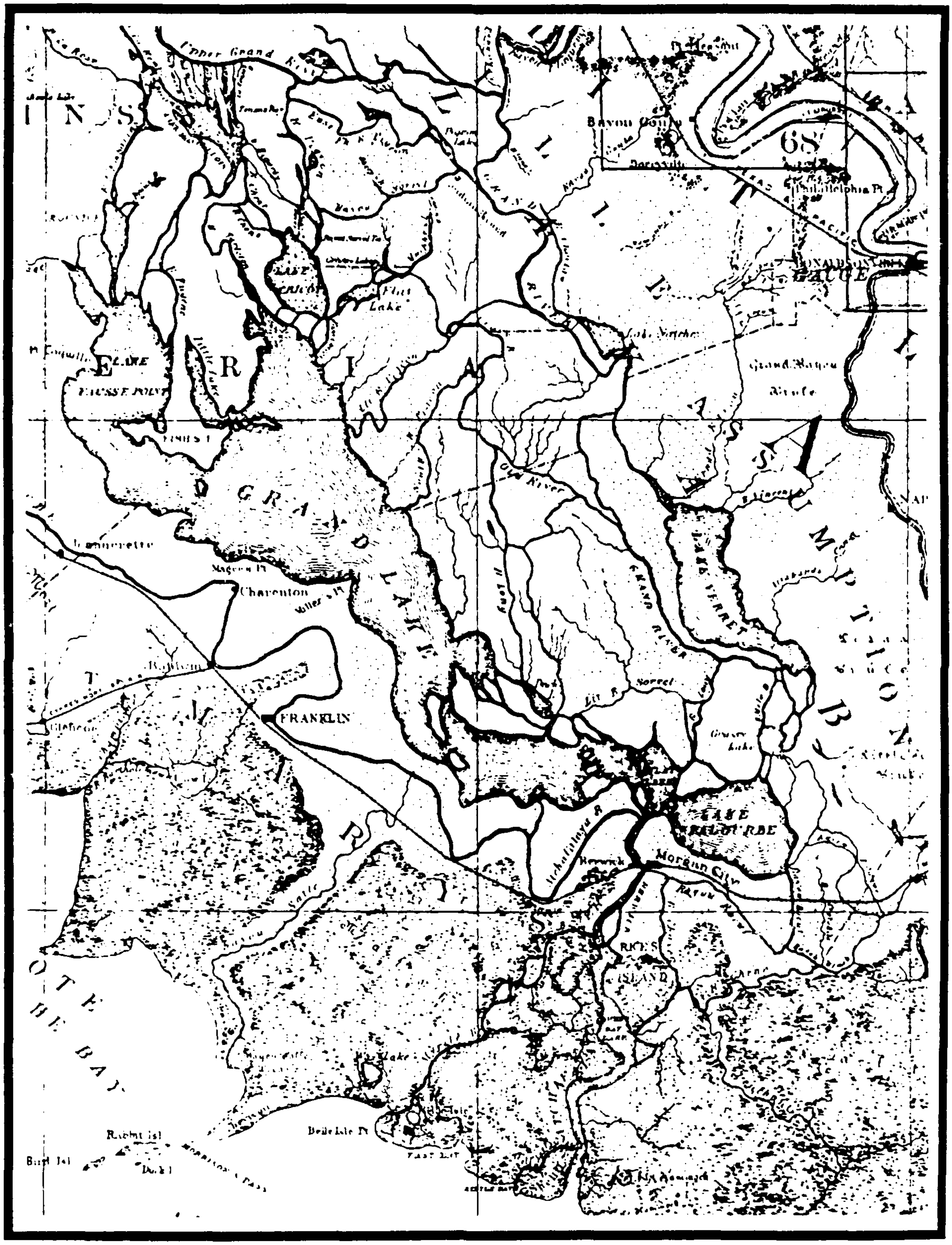

Figure 3. Detail of 1884 map showing lake conditions in the lower Atchafalaya Basin (Source: Mississippi River Commission 1884).

the nineteenth century. Lakes in the lower basin area include Lake Fausse Point, Grand Lake, Six Mile Lake and Lake Palourde.

The second event to significantly influence the development of the modern Atchafalaya Basin occurred approximately 500 years ago. At that time there was a shift in the course of the Mississippi River at Turnbull Island, about 50 miles above Baton Rouge. This resulted in a change in position of the mouth of the Red River and the initial formation of the Atchafalaya River as a distributary of the Mississippi. Continued flow into the newly formed Atchafalaya soon established it as a significant distributary, eventually, providing increased flow and sedimentation into the Atchafalaya Basin.

The final event leading to the formation of the modern Atchafalaya Basin consists of a series of man-produced activities undertaken since the middle of the nineteenth century. These various activities have been directed, primarily, at improving the navigability of various streams in the Atchafalaya Basin and at flood control. These include the clearing of a large log raft at the head of the Atchafalaya River to accommodate steamship navigation; the construction of guide levees and navigation structures; the construction of levees; dredging; and, in 1963, construction of the Old River Control Structure. This structure has served to regulate flow into the basin at 30 percent of the Mississippi River discharge and, also, is intended to prevent capture of the Mississippi River flow down the Atchafalaya Basin.

These activities have significantly altered the basin, particularly through a great increase in the amounts of sediment carried into and deposited in the area. The increased sedimentation is converting the basin from a predominantly swamp and lake environment to an increasingly terrestrial one. The lower basin area, which includes the two project areas, has undergone the most obvious changes in recent years. This region has experienced massive filling in a relatively short period of time. Since the early 1900s, an estimated 85 percent of the lake system in the lower basin has been filled, as shown in Figure 4. The extent of filling is obvious when one compares the size of Grand Lake through much of the nineteenth century, as indicated in Figures 2 and 3, with the post-1900 changes shown in Figure 4. Smith et al. (1986:54) estimate that complete filling of Grand and Six Mile Lakes is likely by the year 2000.

The two project areas mirror the processes of sedimentation and filling that are occurring in the lower basin as a whole. Figure 5 presents information on the amount of filling and land formation that has occurred at the Blue Point Chute project area since 1917. Prior to 1917 this project area fell within Grand Lake, at that time the largest lake in the basin. While there is no specific hydrographic information from the project area for that period, in general, Grand Lake was relatively shallow. John Landreth, who was involved in a survey of timber resources along the lower Atchafalaya Basin area for the United States government in 1818 and 1819, provides some useful information on the character of the region at that time (Newton 1985). During his travels across Grand Lake Landreth commonly noted water depths. Generally, the lake was on the order of 6 to 10 feet deep and the deepest measurement, made near the middle of Grand Lake, was 21 feet (Newton 1985:31). Between 1917 and 1950 extensive filling occurred to the east and northeast of the Blue Point Chute project area (Figure 5). It was during this period that the narrow waterway which became Blue Point Chute was formed. Since 1950 most of the sedimentation and filling in this area has occurred to the west of the project area, with the growth and extension of Cypress Island toward the north (Figure 5). The Atchafalaya Main Channel, which runs through the project area, is a maintained channel whose existence is related as much to human activities as to natural processes.

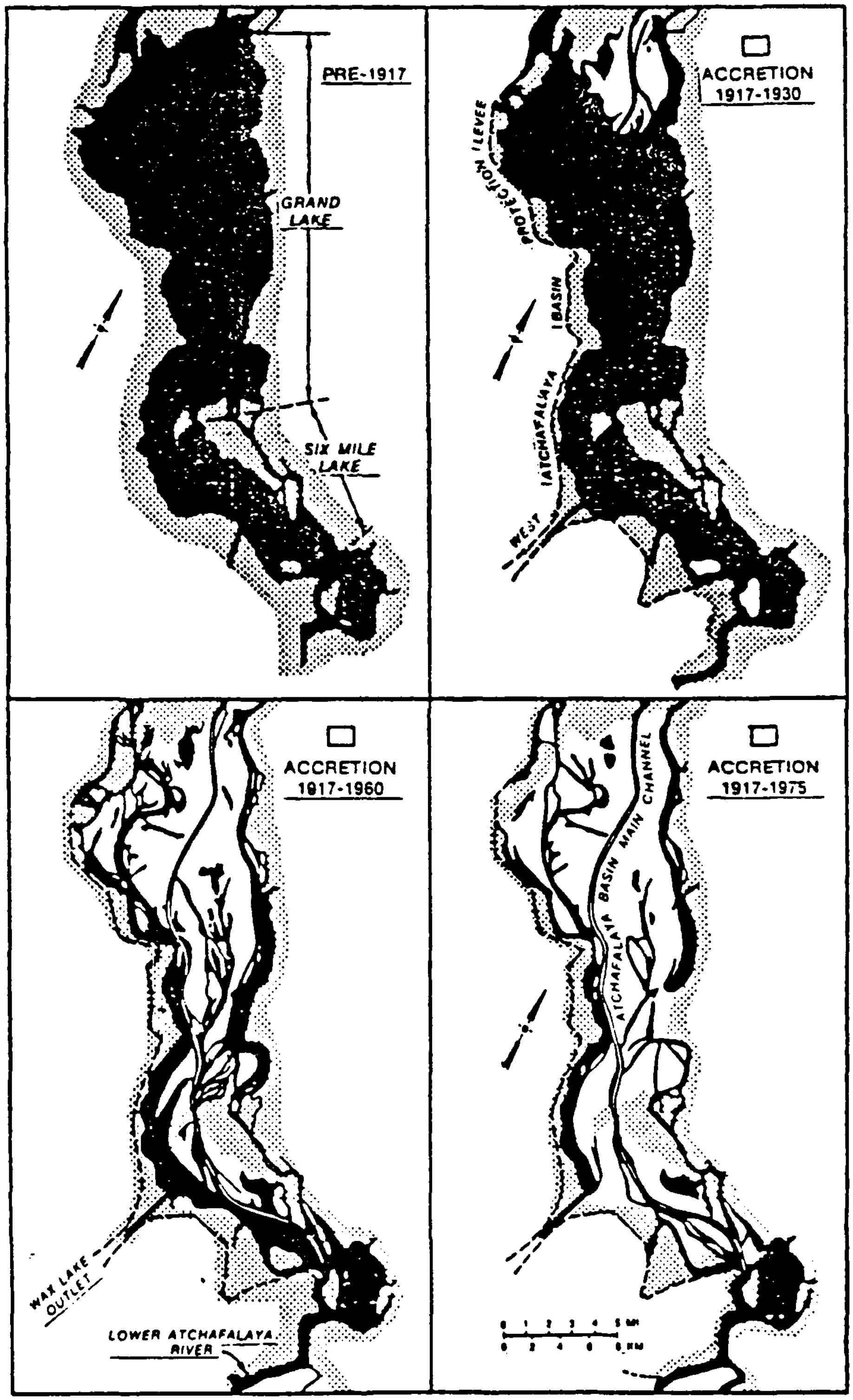

Figure 4. Filling of Grand and Six Mile Lakes (Source: Smith et al. 1986).

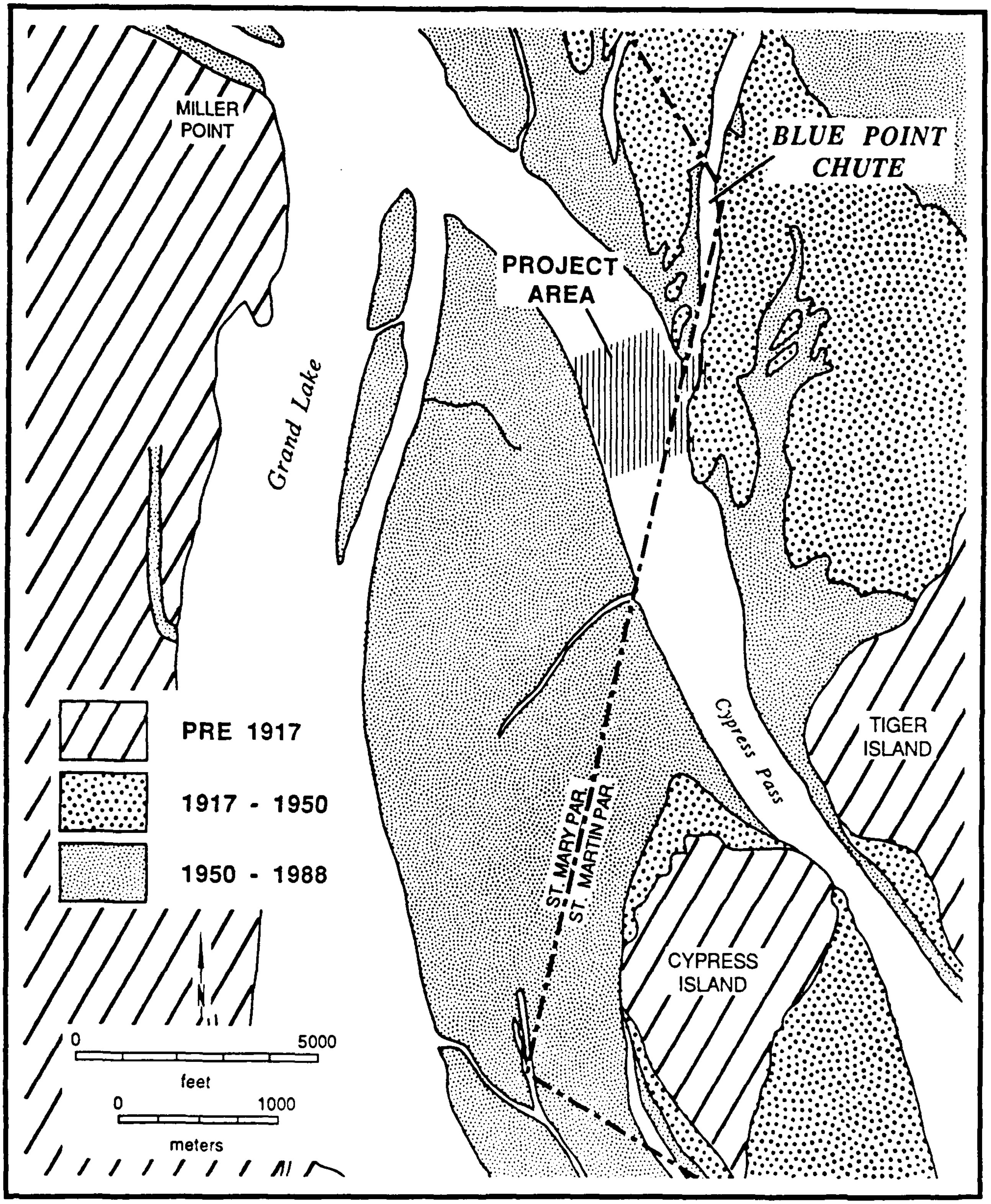

Figure 5. Sequence of filling in the Blue Point Chute area.

Figure 6 provides information on the extent of filling that has occurred in the area of the American Pass project area. Little filling occurred in this area during the 1917 to 1950 period. Since 1950, however, extensive sedimentation and land formation has taken place. Like Blue Point Chute, the American Pass project area fell entirely within an area of open and shallow lake waters prior to 1917. The Atchafalaya Main Channel, running through the American Pass project area, is a man-produced, maintained channel. American Island has been extant since, at least, the early nineteenth century. In January of 1819, John Landreth surveyed what he called the "Chetimaches or Seven Islands", one of which he named "Island No. 5" (Newton 1985:44-52). Now known as American Island, Landreth indicated that Island No. 5 contained 2375 acres and a "considerable quantity of Live Oak of a small class..." (Newton 1985:46). He also reported that Island No. 5 was surrounded by "fine navigable Bayous open to the Lake", suggesting the possibility of navigation in the channels around American Island. In his journal, Landreth refers to American Pass as "Bayou Aligator" (Newton 1985:45). Since, and no doubt before, Landreth's time, American (or Grand) Pass has served as a water route to Bayous Sorrel and Boutte and on into the interior of the Atchafalaya Basin. American Pass has apparently never been a major route for commerce, and the vessels using this stream probably consisted mainly of pirogues, bateaus and, possibly, small luggers and, more recently, a variety of small motorized boats.

Navigation History of The Project Areas

Over the past 10 years a number of studies have appeared that provide information on prehistoric and historic settlement and use of the Atchafalaya Basin. Probably the best synthesis on human history in the basin is found in Jon Gibson's work (Gibson 1982). Other studies resulting from cultural resources management projects provide information on the history of the basin and the surrounding area (e.g., Goodwin et al 1985, 1986). In addition, a large literature is available that deals with the Acadians of south Louisiana. Of particular pertinence are the works that deal with Acadian life in the Atchafalaya Basin (e.g. Comeaux 1972, 1978; Conrad 1978; and Knipmeyer 1956). Details on the human history of the Atchafalaya Basin can be found in the works referenced above. In the present study only a brief assessment of the history of the region is given with an emphasis on the use of watercraft in the area and on the potential that the project areas have for containing the remains of boat wrecks.

Because of its wet and swampy nature, most of the Atchafalaya Basin has always been inhospitable to human settlement. The archaeological record indicates that much of the prehistoric settlement of the region was confined to the fringes of the basin and to a few areas of high ground within the interior (Gibson 1982). The Atchafalaya Basin is, however, a rich ecosystem and there is no doubt that prehistoric populations utilized it extensively for hunting, fishing and collecting. Access into and across the basin would have been entirely dependent upon water transportation. A number of well-established water routes were in use by the native inhabitants of the basin area when Europeans first arrived. Use of these waterways certainly extended well into the past. All of the available historical evidence indicates that the watercraft used by aboriginal groups in Louisiana was the dugout canoe or, as it came to be called by the French, the pirogue. These canoes were made from single logs, usually cypress, and, based upon the few examples known from Louisiana, were often up to 30 feet or more in length (Pearson et al. 1987). Over millennia of use in the Atchafalaya Basin, there is no doubt that many of these canoes were lost or abandoned and remain buried and preserved in the anaerobic environment produced by the thick sediments of the area.

Early European settlement in the Atchafalaya Basin was limited to the Teche ridge, at the western periphery. In 1765 the Poste de Attakapas (present-day St. Martinville) was

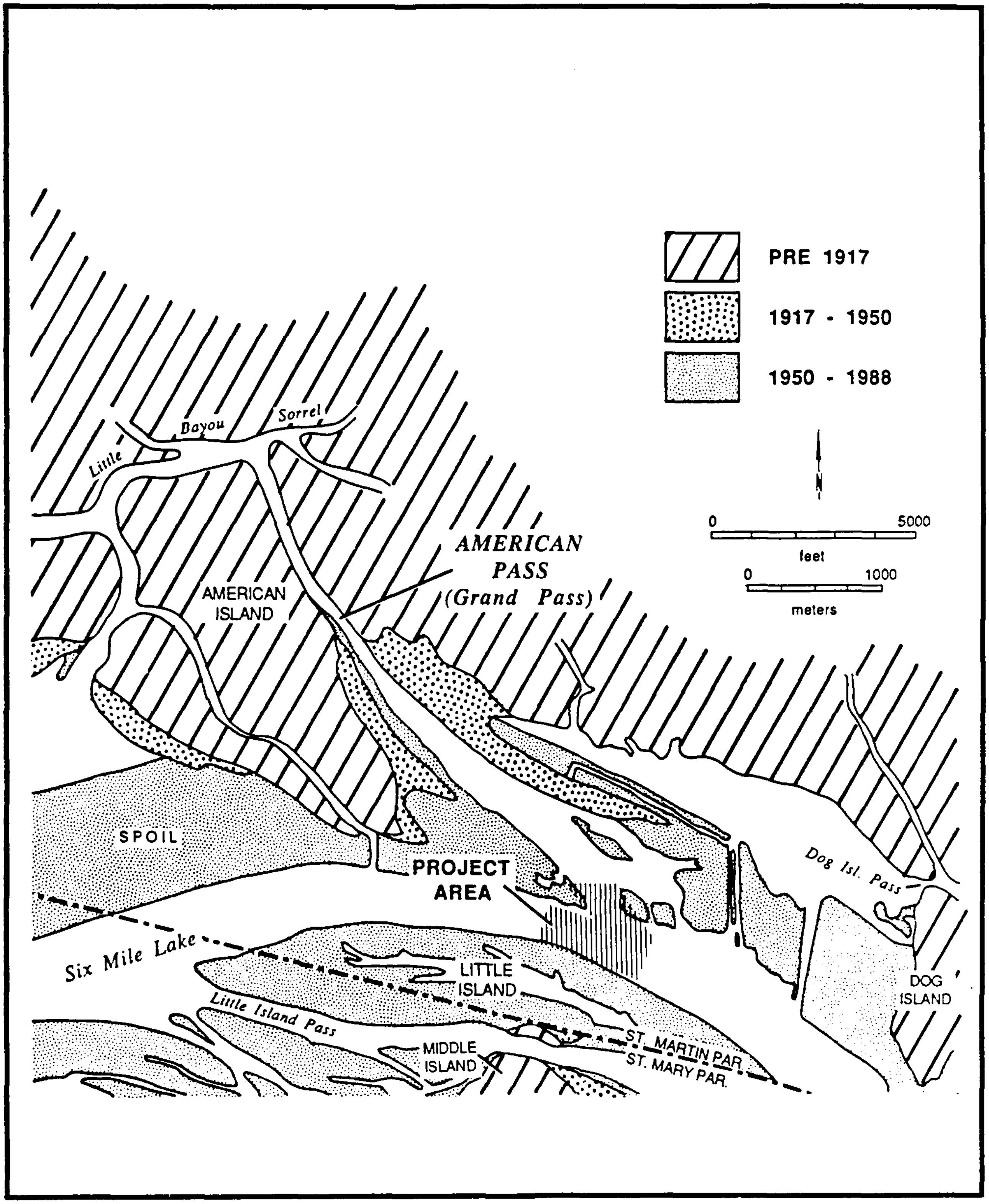

Figure 6. Sequence of filling in the American Pass area.

established by several hundred Acadian refugees. Later, in 1766, a small Spanish settlement was established at New Iberia. Throughout the Spanish period (1763-1803) immigration into the area continued and settlement along the natural levees of Bayou Teche grew and expanded. The early settlers were primarily subsistence farmers and many certainly visited the adjacent Atchafalaya Basin swamps as trappers, hunters and fishermen and also to extract cypress and live oak timber.

The waterways of the Atchafalaya Basin also provided transportation routes eastward to the Mississippi River and Bayou Lafourche. In the eighteenth century there were two main routes through the swamp. Both entered the eastern side of the basin, through Bayou Plaquemine, a distributary of the Mississippi River (Gibson 1982:110-111). The northern route "followed Bayou Plaquemine to Bayou Grosse Tete and then along Grand River, Atchafalaya River, and Bayou Courtableau to Bayou Teche at Port Barre." (Gibson 1982:110-111). The southern route followed Bayou Plaquemine, Grand River and Bayou Sorrel and entered into the northern end of Grand Lake. From there this route continued across the lake to the Lower Atchafalaya River and on into Bayou Teche near present-day Patterson. As Comeaux notes (1972:10), several other minor routes also were in use. One used Bayou Pigeon to cross the interior of the basin and one connected the Lower Atchafalaya River to Grand River through Lake Palourde.

A variety of small boats plied these waterways in the eighteenth and on into the nineteenth century. Some of these types of boats continued in use until recent times. The European settlers quickly adopted the dugout canoe of the Indians and the pirogue became probably the most common watercraft used. Other types of boats which came into use were the chaland, esquif and the bateau. The chaland is a rectangular, flat-bottomed boat, normally only 10 to 14 feet long. This boat was most often used as a ferry or for transporting bulky loads for short distances (Knipmeyer 1956). The esquif, or skiff, is flat bottomed with a pointed bow and blunt stern. Skiffs were propelled by sails and/or oars. Knipmeyer (1956:167) indicates that the skiff became more popular through time as the use of the pirogue declined. The term bateau actually can refer to several types of vessels. The eighteenth century bateau was a flat-bottomed boat, tapered at both bow and stern, which was used as a cargo carrier. Bateaus ranged from 12 feet in length to greater than 80 feet, however, most were from 20 to 40 feet long. The bateau could be rowed, poled or sailed. The large bateaus were used on the Mississippi River beginning in the eighteenth century, while the smaller ones were employed on the lesser streams of south Louisiana (Pearson et al. 1987:95). It is probable that some of these cargo bateaus were used on the waters of the Atchafalaya Basin.

As presently used, the term bateau also refers to a large, flat-bottomed boat with a blunt bow and stern. These craft are usually over 15 feet long, 5 feet wide and sheered forward. Sometimes, the deck of bateaus are partially planked to provide a working space. This type of boat is still being used in the Atchafalaya Basin.

The common characteristics of all of these vessels are that they are shallow draft, relatively small and tend to be flat-bottomed. These attributes were, and continue to be, ideally suited for the shallow and often narrow waterways found in the Atchafalaya Basin.

Beginning in the first decades of the nineteenth century there was a shift in agricultural production along the natural levees of Bayou Teche, leading to the development of the plantation system. The principal cash crops were cotton, indigo and sugar cane. By the 1830s sugar cane had become the dominant crop. The important communities along Bayou Teche at this time were St. Martinville, New Iberia and Franklin. The interior of the Atchafalaya Basin began to be settled as early as the 1840s. During this period, small plantations were established around Bayou Chene (Gibson 1982:124). By 1845

agriculture had begun along Bayous Pigeon and Sorrel and Grand River (Comeaux 1972:15).

With the development of the plantation economy, access to the major market in New Orleans became increasingly important and that access was by water. The importance of travel by water in the region is emphasized in statements by C. C. Robin, who traveled through the region in 1805. He noted:

> People in this country are so accustomed to travel by water that the generic term "voiture" [standard French for "carriage"] is always applied to a boat. If a Louisianian says to you "I brought my voiture"; "Can I give you a lift in my voiture"; he is referring to his pirogue or skiff as a Parisian using the same word would mean his coach. (in Gibson 1982:114).

About 1810 the Attakapas Canal was dug, providing access from Bayou Lafourche to Lake Verret and, thus, to the lower Atchafalaya Basin and the area of Bayou Teche to the west (Prichard, Kniffen and Brown 1945:757). James Leander Cathcart, who lead the 1818-1819 timber survey expedition of which John Landreth was a member, provides some unique descriptions of the types of water transport in use in the region at that time. In January of 1819 he noted in reference to the area of present-day Morgan City:

> ...the flats (so call'd) used at this ferry, are form'd of two large canoes, on which is a platform for houses, the price of carriage for a man and horse is 12 dollars, and for black cattle 1.50 cs per head they cross the lake to the canal which runs into Lake Verrett from Lafourche a distance of 30 miles, and from thence passengers proceed to Donaldsonville, and take passage in steam boats that pass either up or down the Mississippi, at the rate of $12^1/_2$ cts per mile. The flats or double canoes, row with two or more oars, and sail when the wind is fair, the rudder is on one canoe only, the pilot sits on the platform, and steers with a yoke and lines, as he would a gid or wherry (Prichard, Kniffen and Brown 1945:796).

Cathcart's fellow traveler, John Landreth, while on Bayou Teche in March of 1819 reported that:

> "now the western waters are high there is a constant passing of boats loaded with the produce of the country for the New Orleans Market Sugar and cotton &c a number of what they call keel boats pass Franklin every day down the Teche carrying from one hundred to three hundred bales of cotton each these boats are generally rowed by Eight ten and twelve oars and a man to steer" (Newton 1985:124)

While these keel boats may have been used on the Teche, it is unlikely that they would have been used extensively on the shallow water lakes found in the lower Atchafalaya Basin.

Steamboats seem to have first reached the Atchafalaya Basin in about 1819. One of the first in use was the 103 ton <u>Louisianais</u>, constructed in New Orleans. This boat was used mainly as a cattle ferryboat. By 1820 the Attakapas Steamboat Company was operating the 295-ton steamer <u>Teche</u> between New Iberia and New Orleans (Goodwin et al. 1985:184). Another early boat was the <u>Volcano</u>, a 217-ton steamer used as a cattle boat. In 1825, Captain Robert Curry brought the small, 48 ton <u>Louisville</u> through Bayou Plaquemine, across the Atchafalaya Basin to the town of Franklin on Bayou Teche (Planter's Banner 4/27/1848, in Gibson 1982:116). Later steamers followed the route established by Curry.

By 1827, clearing of Bayou Sorrel and Lake Chicot for navigation had begun. Steamboat navigation in the Atchafalaya Basin was seasonal; largely dependent upon high water. Fortunately, high water occurred during the winter and spring, when agricultural products (mainly sugar and cotton) were ready for market. In addition to agricultural products and passengers, livestock became an important commodity in the steamboat traffic in the Atchafalaya Basin. Large numbers of cattle were raised in the prairie lands of western Louisiana, driven to the points on the western side of the basin and transported across to Bayou Plaquemine (Duperier 1979:59-60, in Gibson 1982:117). Bayou Teche was navigable year-round and large steamers could reach as far as New Iberia, which eventually developed into a major inland center for water transportation (Gibson 1982:116).

In 1857 the New Orleans, Opelousas and Great Western Railroad was completed from Algiers on the Mississippi River to the east bank of the Atchafalaya River at Berwick Bay. At the termination of the railroad, the town of Brashear City, later to become Morgan City, developed.

During the Civil War there was a considerable amount of naval activity in the area around Brashear City and along Bayou Teche. Some of this activity spilled over into the waterways of the Atchafalaya Basin. In early April of 1863, a large Union force under the command of General Nathaniel Banks was concentrated around Brashear City with the intention of moving against the Confederate forces of General Richard Taylor at Fort Bisland, located several miles above on Bayou Teche. One element of the Federal strategy involved boating troops across Grand Lake to its western shore where they landed and crossed overland to Bayou Teche (Official Records of the Union and Confederate Armies 1882:294). Eventually the southern forces were forced to retreat up the Teche, however, several vessels were lost or scuttled in Bayou Teche during the course of the engagement.

A brief naval engagement did take place on Grand Lake during these activities. The Confederate ram, Queen of the West, (formerly a Federal vessel) accompanied by two troop transports, the Grand Duke and the Mary T. had been dispatched from Butte La Rose with reinforcements to strengthen Taylor's force at Fort Bisland. (Scharf [1977] indicates that the Queen of The West was accompanied by only one vessel, the Minna Simmons). The Confederate flotilla was sighted on April 13 by Union naval forces consisting of 3 gunboats; the Calhoun, the Estrella and the Arizona. The Calhoun fired on the Queen of the West, hitting a steam line and setting her on fire. Soon after she exploded and sank in Grand Lake with an estimated loss of 40 persons (Scharf 1977:363). The Confederate transports escaped to Butte La Rose. With the retreat of most of Taylor's forces from the region, four Union gunboats, the Calhoun, the Estrella, the Arizona and the Clifton, steamed up the Atchafalaya Basin and were able to capture Fort Burton at Butte La Rose.

Later, in June 1863, with Union attentions directed toward the capture of Port Hudson on the Mississippi River, General Taylor initiated a plan to retake the lower Teche, Atchafalaya, and Lafourche regions. Part of this plan included moving troops by boat across the Atchafalaya River and down the east side of the Atchafalaya Basin to capture Brashear City. Simultaneously troops were to move down the Teche. Those moving down Bayou Teche, under command of Major Hunter, were loaded into a flotilla of small boats when they reached the lower Teche. This flotilla, consisting of 53 skiffs, pirogues and bateaus, and known as the "Mosquito Fleet", passed down the Teche, through the Lower Atchafalaya River at Patterson, across the lower end of Grand Lake to Lake Palourde from where they could attack Brashear City from the north (Raphael 1976:167-168). The Confederate forces were able to retake the city.

In September of that year, Federal forces initiated a major campaign to retake the lower Atchafalaya region and to move on to the west to invade Texas. Known as the Great Texas

Overland Expedition, forces recaptured Brashear City, moved up to the Teche and on to Opelousas.near where the expedition was halted. Low water on the streams of the Atchafalaya Basin inhibited shipment of supplies to Union forces and, eventually, they were forced to retreat under harassment by Rebel troops. Union forces withdrew to the Teche and spent the winter of 1863 at New Iberia and St. Martinville. The following Spring, Union forces attempted to move into Texas via the Red River but were unsuccessful and withdrew back to the Mississippi River. This also resulted in the removal of most Federal troops from the Atchafalaya Basin region.

Agriculture within the Atchafalaya Basin had essentially ceased during the war (Comeaux 1972:17) and with it commercial water traffic in the region. By the early 1870s navigation of the Atchafalaya area was again considered necessary, as indicated by a survey of the Atchafalaya River by the Army Engineers in 1873-1874. That survey noted that the river provided a relatively deep channel, averaging over 20 feet deep, for most of the distance between the Red River to Berwick Bay (at Morgan City), although numerous shallow shoals did occur. Many small feeder channels were noted along the length of the Atchafalaya River. However, their navigation was often dependent upon water stage and rafting (Annual Report of the Chief of Engineers, U.S. Army Corps of Engineers 1874; hereafter cited ARCE). That report presented the following information on commerce on the waterways of the basin:

> The products of the Atchafalaya country are cotton, sugar, molasses, moss, lumber, staves and shingles. The cotton is all grown above the Courtableau and is sent to New Orleans by the two steamers that run to Washington, or the one that makes a ten-day trip to the Teche country.
>
> The lumber and staves are rafted down to Brashear and the Teche, seven small steamers being engaged in this trade.
>
> Flat-boats and broad-horns from Indiana and Ohio bring down hoop-poles, flour, bacon and provisions, for sale on the Teche, generally taking the route by Grand River, Seventh Tensas, Jake's and Rigaby's Bayous, making as short a run over Chicot and Grand Lake as possible, and keeping as near to the left bank as the depth will permit, in order to find shelter in the bayous in case of wind. United States contractors for live-oak have a depot at the one hundred and thirty-fourth mile, on Berwick's Bay, where they collect large supplies of this valuable material from points as far above as the Bayou Chene, and ship by schooner. (ARCE 1874:771-774)

The navigation route described here, particularly the reference to "keeping as near to the left bank as the depth will permit" when crossing Grand Lake, places the preferred route of travel near the two project areas being considered in this study.

During this period, waterborne commercial activity increased from Morgan City. In 1888, this activity included:

> ...two Morgan Line Steam-ships, one running to Texas ports about once in ten days, and one to Mexico once in two weeks; 25 schooners, and 30 luggers and sloops passing in and out an unknown number of times. (ARCE 1889:1510)

Many of these out-bound vessels were carrying produce brought down and through the Atchafalaya Basin. In order to avoid potentially dangerous boat travel across the open Gulf

of Mexico, vessels bound to the east often meandered through an elaborate system of interconnecting streams across the basin. This 425 mile water route followed:

> "..the Teche into the Atchafalaya, Grand Lake, Lake Chicot, Lake Mongoulois, bayous La Rompe or Little Tensas into the Grand or Atchafalaya river again, thence into the Mississippi, through Old River, to New Orleans..." (ARCE 1885:1434)

Although the water route across the Atchafalaya Basin was cheaper, shippers preferred to use the railroad. By 1885, the Morgan Railroad accounted for 90% of the commerce between the Teche country and New Orleans (Pearson et al. 1987:263). By that year, only one boat, the steamer New Iberia, made regular trips between Bayou Teche and New Orleans (ARCE 1885:1439). Coal barges continued to carry their cargo downstream to Morgan City and Bayou Teche and cypress logs from the Atchafalaya Swamp were shipped and floated across the basin to lumber mills along the Lower Atchafalaya River. Small channels in the basin, such as Bayou La Rompe and Bayou Little Tensas, which had been important for boat travel in the nineteenth century, were rarely utilized for commerce in the twentieth century. The last steamboat to operate on Bayou Teche was the Amy Hewes which was used primarily as a logging boat to haul rafts of cypress logs out of the Atchafalaya Basin to local sawmills. The Amy Hewes ceased operating in 1943 (Goodwin et al. 1985:188)

Since the 1930s commercial traffic in the interior of the Atchafalaya Basin has been confined primarily to the navigation channels built or maintained by the Corps of Engineers. The smaller waterways of the basin continue to be used by large numbers of fisherman, hunters and trappers both for commercial and recreational purposes.

Shipwreck Potential of the Project Areas

The potential for either of the two project areas containing shipwreck remains is related to: 1) the history of vessel use and loss in the area and 2) the impacts which natural and man-induced forces have had on any wrecks since their loss. The previous discussions on the geology and history of watercraft use in the Atchafalaya Basin provides a beginning point for assessing the shipwreck potential of each of the project areas. Added to this is information on historically documented boat wrecks in these areas provided in the available literature, much of which has been synthesized in Pearson et al. 1987.

Blue Point Chute Project Area

Prior to 1950, the Blue Point Chute project area fell within the boundaries of Grand Lake (see Figure 5). Grand Lake served as part of the normal route for shallow-draft boats and steamers traveling up and down the basin, and there is some indication that the preferred navigation route crossed near the project area. The historical documentation records few wrecks in Grand Lake itself. One which did occur near the project area was the Confederate steamer Queen of the West, sunk by Union shells in April of 1863. The Queen of the West reportedly sank near Miller Point, just a few miles northwest of the Blue Point Chute area (see Figure 5). She was identified at this location in the 1874 Army Engineer survey (ARCE 1874:774), however, in 1895 the remains of the Queen of the West were, reportedly, completely removed (ARCE 1896:1520). The 1874 survey also recorded the remains of another vessel, the steamer Thompson, sunk near Cypress Island (ARCE 1874:774). The Thompson's specific location is not known but it seems to have been in the vicinity of the project area.

The geological process most likely to have influenced the preservation of shipwreck remains in this area has been sedimentation. As noted earlier, extensive infilling has, and continues, to occur in the Blue Point Chute project area. Within the area surveyed, however, water depths now are not significantly different from what we believe they were in the nineteenth century. While much of Grand Lake has been converted to dry land, many of the remaining water bodies and water courses maintain depths similar to those of the pre-filling period. This suggests that shipwreck remains that may occur in the project area are not likely to be be deeply buried. There is no doubt, however, that sunken vessels will be deeply buried in those areas of the basin that have been converted to dry land through sedimentation.

While they may not be deeply buried, any amount of burial would aid in the preservation of shipwreck remains in the project area. The silt and clay sediments that are filling the area would produce a low-oxygen environment, inhibiting decay of wood and other organic remains.

The available historical and geological information argue that there is a low probability of shipwreck occurrence in the Blue Point Chute project area. While there is evidence that the project area lies near to the historic navigation route across Grand Lake, losses in this area would have been chance occurrences. There are no indications that hazards, such as snags, bars, etc. which could have caused sinkings were common in the vicinity of the project area. Saltus (1985) has demonstrated that shipwrecks accumulate at landing areas through both loss and abandonment. There is no historical evidence that any landing ever existed in or near the Blue Point Chute project area.

American Pass Project Area

The geological evidence indicates that the American Pass area also lay within the shallow waters of Grand Lake prior to 1950 (see Figure 6). Like the Blue Point Chute area, this locale was near the historic navigation route across Grand Lake, but sinkings would have been chance occurrences. There is no evidence that landings existed near this project area. American Pass itself has been a navigable channel since, at least, the early part of the nineteenth century and it did provide access into the interior parts of the Atchafalaya Swamp. There is no doubt that a variety of small boats have used American Pass over the past two hundred years or more and where there is a concentration of vessel use (e.g. landings, navigation channels, etc.) the probability of sinkings increases. An examination of Figure 6 does indicate, however, that the project area falls well outside of the channel of American Pass as it existed prior to 1950. Except for the steamer Thompson mentioned above, there are no shipwrecks reported in the immediate vicinity of the American Pass project area (Pearson et al. 1987).

Like the Blue Point Chute area, extensive sedimentation has occurred in the American Pass area. However, in most of the project area examined, water depths are little different from those which are presumed to have existed in the nineteenth century. It is presumed that any historic vessel remains which may exist in the area surveyed will not be deeply buried. As noted above, however, any amount of burial will aid in the preservation of organic remains.

In light of the available information, there is a low probability that vessel losses have occurred in the American Pass project area. However, because of its nearness to a channel that has probably been used by small craft for a considerable period of time (American Pass), the probability of vessel losses must be considered slightly higher than for the Blue Point Chute area. Vessel remains that do exist will not be deeply buried, however, any organic remains that do exist will probably be reasonably well preserved.

CHAPTER 3: REMOTE SENSING SURVEY

Introduction

Magnetic survey in the search for shipwrecks has become increasingly common in recent years. The principles of how magnetometers work and their early application to marine archaeology were reported by Breiner and MacNaughton (1965). Pioneering work to plot the distribution of segments of a specific marine wreck as an interpretive aid was done by Clausen off the Florida east coast (Clausen 1966). Since that time, a number of researchers have contributed to the growing body of data involving the use of magnetics to locate shipwrecks (e.g. Green 1970, Hays and Herrin 1970, and Arnold and Clausen 1975).

A number of research projects have been undertaken that have dealt, primarily, with watercraft or shipwrecks in south Louisiana. These have included historical overviews of navigation history and vessel use, evaluations and enumerations of shipwrecks, remote sensing surveys and archaeological investigations of specific wrecks. The historical overviews have included a compilation of shipwrecks along the Mississippi from Cairo to Head of Passes (GSRI 1974) and a more detailed evaluation and identification of wrecks along the Mississippi River below Baton Rouge (Detro et al. 1979). Recently Pearson et al. (1987) have compiled a history of waterborne commerce and navigation for the area of the New Orleans District which includes a compilation of shipwrecks and assessments concerning the nature and potential of shipwreck remains within the confines of the district.

Several remote sensing surveys, designed primarily to locate shipwrecks, have been conducted along stretches of the Mississippi River below New Orleans. In 1982-1983 the Corps of Engineers conducted a remote sensing survey at several locations along the lower parts of the river (USACE 1983). Twenty magnetic anomalies were recorded, although none were physically examined. Magnetometer and side-scan sonar survey has been conducted in the Mississippi River in the vicinity of Forts St. Philip and Jackson (Saltus 1983). The purpose of this study was to locate vessels known to have been lost in the area during the Civil War. A number of magnetic anomalies were recorded and diving was conducted at eight locations. Most proved to be modern debris, however, one may represent the remains of the CSS Warrior.

Additional magnetic survey has been conducted in the Mississippi River between the communities of Buras and Venice (Saltus 1984). Eighty eight magnetic anomalies were recorded in this study and several were examined by probing. None were identified as shipwrecks. The Corps of Engineers conducted a remote sensing survey within a 30-mile stretch of the Mississippi below the Head of Passes (Muller 1985). A number of magnetic anomalies and side-scan targets were recorded but none were examined further.

In January of 1984 the Corps of Engineers conducted a magnetometer survey of a proposed offshore borrow area off Fort Livingston in Barataria Bay, Jefferson Parish. A number of magnetic anomalies were located but none were identified through physical examination (Stout 1984).

In 1983 the New Orleans District conducted a magnetometer survey of a 6.75-mile-long portion of Bayou Grand Caillou in Terrebonne Parish (Flayharty and Muller 1983). During this boat survey 69 exposed watercraft sites were identified and 6 were deemed potentially eligible for inclusion in the National Register of Historic Places. In addition, numerous magnetic anomalies were recorded, however, none were investigated further.

Several magnetometer surveys have been undertaken along the southern shores of Lake Pontchartrain (New World Research 1983; Stout 1985a, 1985b). One of these lead to the discovery of a sunken vessel, presumed to be a schooner or schooner barge. This wreck was deemed potentially eligible for nomination to the National Register (Stout 1985a).

Among the most productive of the remote sensing studies undertaken in south Louisiana has been the work of Allen Saltus (1985, 1986, 1988). This research has involved magnetometer surveys of several rivers flowing into Lakes Maurepas and Pontchartrain in southeastern Louisiana. These surveys have recorded a number of magnetic anomalies and subsequent diving has located a number of sunken vessels or portions of vessels.

The Red River in Louisiana has been the subject of a number of magnetometer surveys, both terrestrial and riverine, intended primarily to locate historic steamboat wrecks. These include two studies by Gulf South Research Institute (GSRI 1975, 1980), which together located over 900 magnetic anomalies, some of which are presumed to be related to shipwreck remains. Neither of these studies included physical examination and identification of the sources of anomalies. In 1980 Rone Engineers, Inc., conducted a study involving the relocation and identification of several of the previously recorded magnetic anomalies on the Red River (Rone Engineers, Inc. 1982). That study employed divers in an effort to identify sources of anomalies. The divers failed to find any obvious remains of shipwrecks. In 1980 and 1981 Coastal Environments, Inc., conducted a terrestrial magnetometer survey at 17 proposed construction along and adjacent to the Red River channel (Pearson et al. 1982). These areas were selected, in part, because some represented former locations of the Red River channel; a recognition that the river's movement has been extensive and that historic shipwrecks may be located outside of the present channel. This survey identified 98 distinct magnetic anomalies. Subsequent examination of several of these anomalies verified and identified the sources of some (Saltus 1983b, Whelan and Pearson 1983). None proved to be the remains of historic shipwrecks.

Only one sunken shipwreck in Louisiana has received extensive archaeological examination. This was the wreck of the El Nuevo Constante, a Spanish merchantman that sank off the coast of Cameron Parish in 1766 (Pearson et al. 1981). An intensive structural and historical study has been undertaken of the M.V. Fox, a small lugger-like boat found onshore in LaRose, Louisiana (Goodwin et al. 1984).

No remote sensing surveys have been reported for the lower Atchafalaya Basin. However, a number of historical and archaeological studies of the region, particularly Bayou Teche, do provide some information on navigation, boat use and shipwrecks in the basin (e.g. Gibson 1982; Goodwin et al. 1985; Goodwin et al. 1986; Pearson et al. 1987).

Magnetic Survey and Anomaly Interpretation

Magnetic surveying involves the measurement of the earth's magnetic field intensity (measured in "gammas") using an instrument known as a magnetometer. The present study is concerned with the application of magnetometers in the search for shipwrecks, details on the physics and mechanics of magnetometers are not discussed here and can be found elsewhere (e.g., Aitken 1958, Breiner 1973). A variety of objects and materials, including buried archaeological features, cause localized disturbances, or "anomalies", in the earth's magnetic field that can be detected with a magnetometer. In terms of physical structure, archaeological objects typically found by magnetic search can be divided into three groups: 1) iron and other ferrous materials; 2) burned features such as fire hearths, kilns, daub, brick, etc.; and 3) unfired features such as wall trenches, ditches, walls, storage pits, etc. The first category of items is most easily identified since ferrous objects

cause significant magnetic disturbances. The other two classes of items tend to be less easily detected. The objects of concern in this study consist of those which are generally most easily identified by magnetic search--large or numerous ferrous objects representing portions of watercraft.

Magnetic signatures (anomalies) can be characterized by two nonexclusive factors: strength (intensity) and shape, both of which are dependent upon a variety of factors related to anomaly source characteristics, including the size, shape and mass of the source object, its magnetic susceptibility, its distance from the point of measurement and the magnetic properties of the surrounding soil . Magnetic anomalies caused by a single-source ferrous object typically produce a positive-negative anomaly pair known as a dipole. The dipole is usually oriented along the axis of magnetization with the negative anomaly falling nearest the north pole of the source object. The positive anomaly reading is commonly of greater intensity than is the negative. Historic shipwreck remains, because they generally contain numerous ferrous objects, most commonly will produce a magnetic signature composed of a cluster or group of dipoles and monopoles. This class of signature is particularly apparent when the wreck remains are scattered and dispersed.

Anomalies of archaeological interest can vary from several hundred gammas, or more, to less than one gamma, depending upon the characteristics of the source and its distance from the point of measurement. As a rule, the strength of the anomaly is proportional to the inverse cube of the distance between the source and the point of measurement. Because of this rapid drop-off in anomaly strength, objects near the sensor are more likely to produce marked variations in magnetic intensity than are more distant objects. A variety of techniques have been developed to estimate anomaly depth (distance from sensor), all of which express varying degrees of error (Breiner 1973).

Even though a considerable body of magnetic signature data for shipwrecks is now available, it is impossible to positively associate any specific signature with a shipwreck or any other feature. The variations in the iron content, condition, and distribution of a shipwreck all influence the intensity and configuration of the anomaly produced. In general, however, the magnetic signature of larger watercraft, or portions of watercraft, are large in area, range from moderate to high intensity (>50 gammas) at distances of 20 feet or so, and may or may not be complex in nature. A complex signature is one that exhibits a cluster of small dipoles and/or monopoles rather than a single dipole or monopole. It should be recognized, however, that complexity is partially dependent upon distance from the source. A magnetic anomaly recorded when the sensor is close to a shipwreck may exhibit a complex configuration because individual ferrous objects are detected; however, at a greater distance the signature may resemble a single dipole because the entire wreck is being recorded as a single-source object. Table 1 provides information on magnetic signatures produced by a variety of identified sources. These data suggest that at a distance of 20 feet or less watercraft of moderate size are likely to produce a magnetic anomaly (this may be a complex signature, i.e.a cluster of dipoles and/or monopoles) greater than 80 or 90 feet across the smallest dimension and have an intensity of greater than about 50 gammas. While recognizing that a considerable amount of variability does occur, this information establishes a beginning point for the identification of the sources of magnetic anomalies in the two project areas.

Survey Methodology and Results

The survey vessel used in this study was a 21 foot, aluminum boat powered by a 50 horsepower outboard engine. The Magnetometer used was a Geometrics model G806 proton precession magnetometer with a Soltec VP-6723S strip chart recorder. Bathymetric

Table 1. Identified Magnetic Anomalies with Associated Gamma Variations And Sizes.

Object	Magnetic Intensity in Gammas	Area (at 10 gamma contour level)	Sensor Distance (Feet)
Engine camshaft	45	45 X 50 feet	15
Section of iron pipe and bucket	250	50 X 60 feet	5
Barbed wire	35	25 X 30 feet	5
Cast iron soil pipe 100 lbs., 10 ft long	1407	45 X 65 feet	4
Anvil, 150 lbs.	598	26 X 26 feet	4
Iron kettle, 22 in. diameter	200	23 X 23 feet	4
Iron anchor, 6-foot-long shaft	30	80 X 270 feet	16
85-foot long, wooden hull, copper sheathed, sailing vessel	35	125 X 225 feet	15
155-ft long, wooden steamer "Lotawanna"	310	300 X 350 feet	15
140-ft long, wooden steamer "Spray"	601	160 X 210 feet	10
55-ft long, wooden schooner "James Stockton"	80	90 X 130 feet	8
126-ft long, wooden ship "El Nuevo Constante"	65	150 X 250 feet	20
150-ft long, Civil War ironclad	4000	200 X 300 feet	20

data were obtained with a King recording fathometer. The magnetometer sensor was mounted on an aluminum pole extended 6 feet forward of the survey vessel. The sensor was 24 inches above the water. Prior to the survey, several tests were run to insure that the sensor was beyond the magnetic influence of the survey boat. The fathometer sensor was mounted over the stern of the vessel.

The positioning system used was a Hewlitt/Packard Total Station. This system uses a 20-second theodolite which measures the azimuth variation from a known point and an infrared EDM that measures the distance from the instrument to a set of mirrors carried in the survey vessel. Distance is measured to the nearest tenth of a foot in the tracking mode, with an accuracy of +/- .02 feet for each 1000 feet of distance. The theodolite was placed at points on the shore that would give optimum line-of-sight over the area to be surveyed. The positions of these on-shore stations were accurately established relative to known Corps of Engineers survey control points found at each of the project areas.

A series of, mainly, parallel transects were run across each of the project areas to obtain systematic survey coverage. These transects were spaced 150 feet apart and were measured in by tape. To some extent, the configuration of the project areas dictated the placement of the survey transects. In both areas, coverage of the Atchafalaya Main Channel was obtained by running transects across the river, perpendicular to the flow. At one end of each of the transects a set of two flagged range poles was placed on the bank. The boat operator maintained the transect line by sighting on these poles. In addition, a compass was used to sight on the range poles to aid in maintaining the transect line. As the survey boat travelled a line, the onshore operator of the theodolite took periodic readings on the mirrors mounted in the boat. These readings provided known positioning points or "shot points" along each line. The mirrors were mounted 10 feet aft of the magnetometer sensor and 15 feet forward of the fathometer sensor.

The magnetometer was operated on a 100-gamma scale and readings were taken every 1 second. A boat speed of about 4 miles per hour was maintained during the survey, resulting in a magnetic reading approximately every 6 feet. An effort was made to obtain shot points every 150 feet or so along each line. When a reading for a shot point was obtained by the theodolite operator this information was relayed by walkie talkie or flag to those in the boat and the shot point was recorded on the magnetometer and fathometer records.

Several problems were encountered during the survey which presented difficulties in running the transect lines. At both of the project areas, the current of the river often made it difficult to maintain a straight line when running transects. Navigation control would have been easier if the transects had been run parallel to the current flow. This would have required placing numerous buoys in the channel to mark the transect lines, an impractical procedure given the amount of commercial barge and recreational boat traffic along the channel. In addition to the problems encountered with the current, strong winds hampered the survey during several days by continually blowing the survey vessel off course. On one day, the survey effort had to be terminated because of the strength of the winds. As can be seen in the following Figures 7 and 10, the survey transects are not perfectly straight, reflecting the realities of the field conditions encountered. Despite these difficulties, adequate systematic coverage of each of the project areas was obtained.

Four individuals were included in the survey crew. Two persons worked in the boat, one operating the magnetometer and fathometer and annotating the records and the other steering the boat. The two individuals on shore operated the theodolite and relayed shot point information to those in the survey vessel. Seven and a half days were spent in the field conducting the remote sensing survey.

Blue Point Chute Project Area

Figure 7 provides information on the results of the magnetometer survey conducted at the Blue Point Chute project area. This figure shows the position of the survey lines, shot point locations, the two stations where the theodolite was positioned and the project baseline established by the Corps of Engineers. In addition, bathymetry (in 5 foot contour intervals) is given for the area of survey falling within the Atchafalaya Main Channel. Contours of all magnetic anomalies with greater than a 10 gamma deflection from the ambient background are shown. The gamma readings of the magnetic peaks of each anomaly are given (Only the last three digits of the magnetic readings are presented on the figure). In light of the information presented above on the anticipated magnetic intensity of shipwrecks, the use of a 10-gamma intensity as a starting point for selecting anomalies of interest must be considered very liberal. This is particularly true for the shallow water areas surveyed, where even very small ferrous objects, such as fishing-line weights, could produce a 10-gamma anomaly. The intent is, however, to provide as complete a visual representation of the magnetic properties of the project area as possible.

Thirty seven lines of survey were needed to achieve coverage of the project area. The main channel was covered with a set of basic survey lines spaced 150 feet apart and running from bank to bank, plus an additional several lines run at angles from the on-shore survey station. These angled lines were intended to complement the initial coverage as well as to transect several anomalies recorded on the basic lines. The mouth of Blue Point Chute, which contains the location of the proposed weir, was surveyed with a series of closely spaced lines generally following the curve of the channel (Figure 7).

Several anomalies, because of their intensity and size, were selected for additional coverage during the course of the field survey. This added coverage consisted of running generally perpendicular transects across the anomaly. Those anomalies selected for additional coverage were Numbers 4, 21, 17 and 18 (Figure 7).

Twenty two anomalies were recorded in this project area. Table 2 provides information on the intensity, configuration and location of each of these anomalies. In addition, Table 2 presents information on the recommended treatment for these anomalies. Only two anomaly sources could be identified. Anomaly Number 7 is related to a channel buoy and Anomaly Number 22 seems to be produced by modern trash scattered along the bankline in Blue Point Chute. Anomaly Number 22 is the only anomaly recorded within the chute and in the near vicinity of the proposed weir construction. Figure 8 presents information on the location of the proposed weir in relation to the location of Anomaly 22. It is apparent that the source(s) of this anomaly falls well beyond the limits of the proposed weir.

All of the other magnetic anomalies fall in the Atchafalaya Main Channel and, while they will not be impacted by the proposed weir construction, some may be affected by future channel dredging operations. It is presently impossible to identify the sources for these anomalies and the only way to obtain accurate identification is through diving and physical examination. However, there are several factors which suggest that most of the anomalies represent small ferrous objects more likely to be modern debris than portions of historic shipwrecks. Examination of Figure 7 indicates that most of the anomalies are located in the western half of the channel, an area of generally shallow water. Figure 9 presents correlated fathometer and magnetometer data for Line 24 which crosses the Atchafalaya Main Channel near the center of the project area. This line is typical of the survey lines across the channel and is representative of the project area as a whole. Two magnetic anomalies were encountered on this line, Anomaly Number 4, in the shallow water at the western end of the line, and Anomaly Number 5, associated with a ridge which parallels

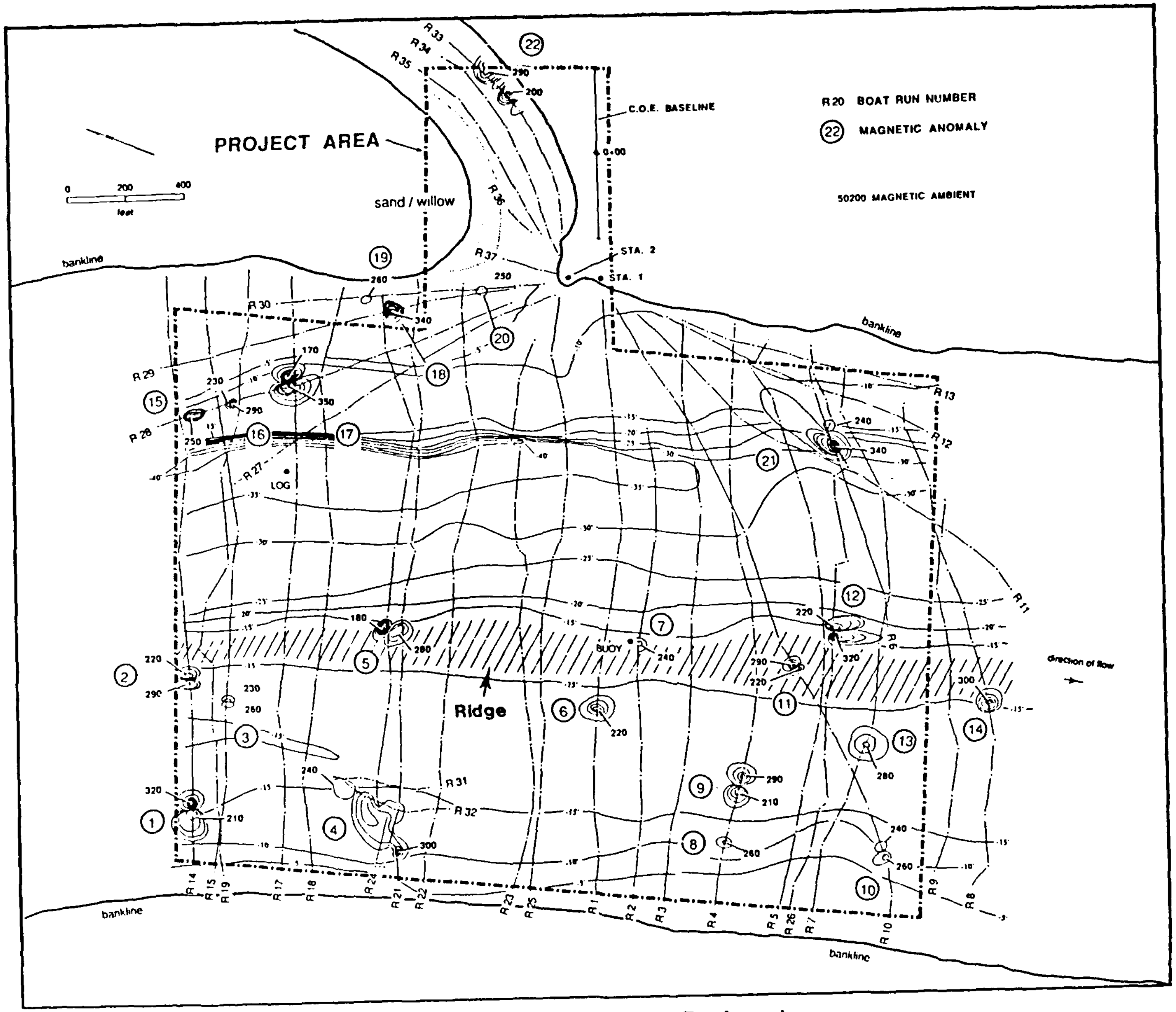

Figure 7. Survey and magnetic data, Blue Point Chute Project Area.

Table 2. Magnetic Anomaly Information, Blue Point Chute Project Area.

Anomaly No.	Deflection (Gammas)	* Character	Length (ft)	Width (ft)	Water Depth (ft)	Location Line Number	Location Shot Point	** Recommended Treatment
1	90	D	170	-	15	14	1-1.25	N
2	70	D	70	-	18	14	2-2.25	N
3	30	D	45	-	12	15	4-5	N
4	50	C	360	160	10	21;24	1-3;2-5	EX
5	100	D	80	140	11	21;24	6-7;8-9	EX
6	40	M	80	-	17	1	4-5	N
7	20	M	45	-	10	2	7	N (Channel Buoy)
8	20	M	35	-	10	4	1-2	N
9	80	D	155	-	16	4	2-3	N
10	30	D	70	-	10	10	2-3	N
11	70	D	65	-	10	10	7-8	N
12	100	D	90	190	14	26;7	8-9;7-8	N
13	30	M	120	-	17	7	4-5	N
14	120	M	80	-	17	8	5-6	N
15	100	M	75	-	11	28	2-3	N
16	60	D	35	-	10	28	3-4	N
17	180	D	180	150	10	28;17	6-7;10-11	EX
18	90	M	60	-	13	29	6-7	N
19	20	M	90	-	12	30	3-5	N
20	10	M	30	-	12	30	8	N
21	100	D	140	385	27	5;6;26	11-12;2-3;15-17	EX
22	90	C	240	-	10	33	1-2	N (modern trash)

NOTES: * D = Dipole; M = Monopole; C = Complex
** N = No further work recommended; EX = Examine for source of magnetics if to be impacted by construction.

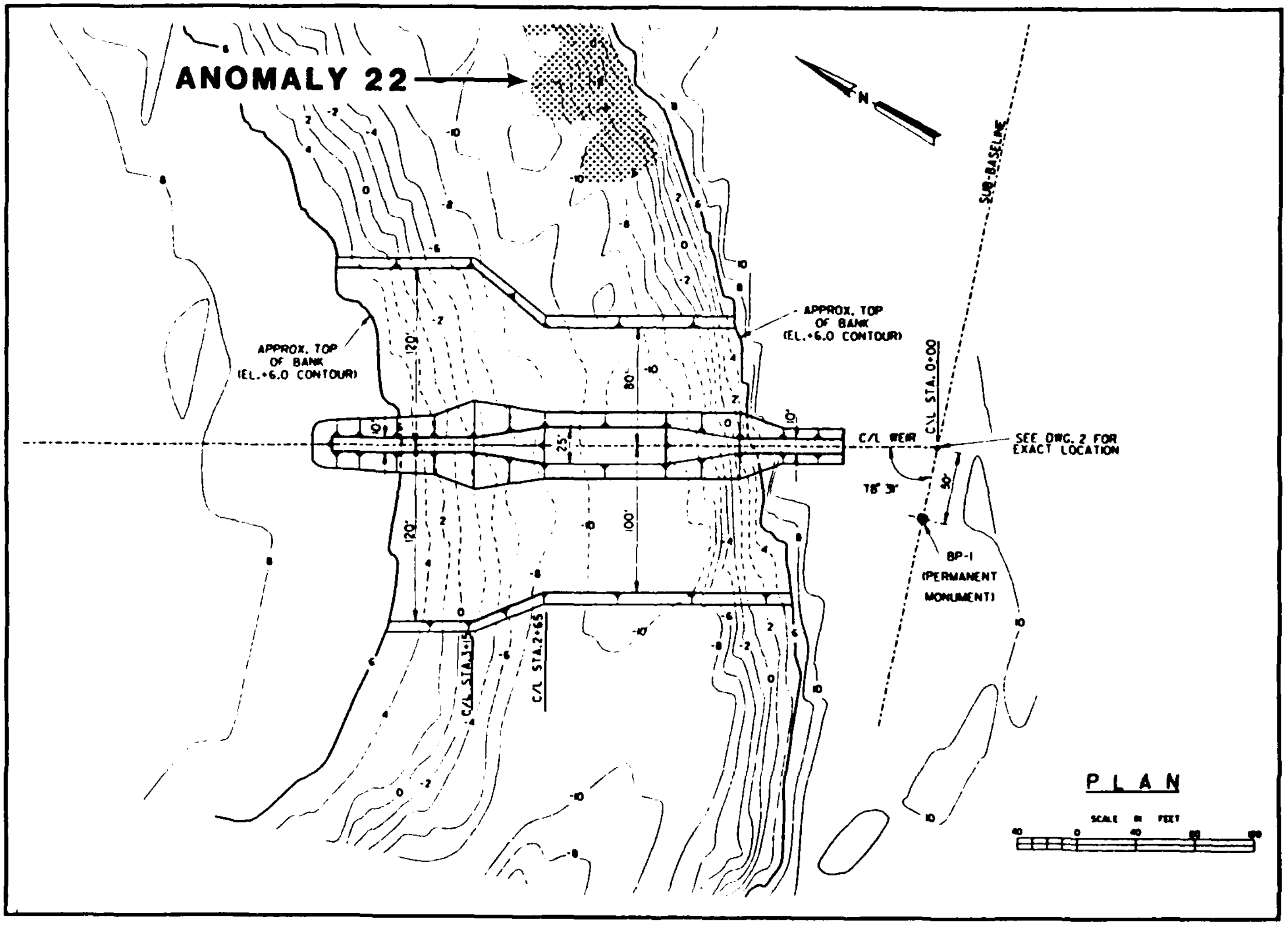

Figure 8. Proposed construction project and adjacent magnetic anomalies, Blue Point Chute Project Area.

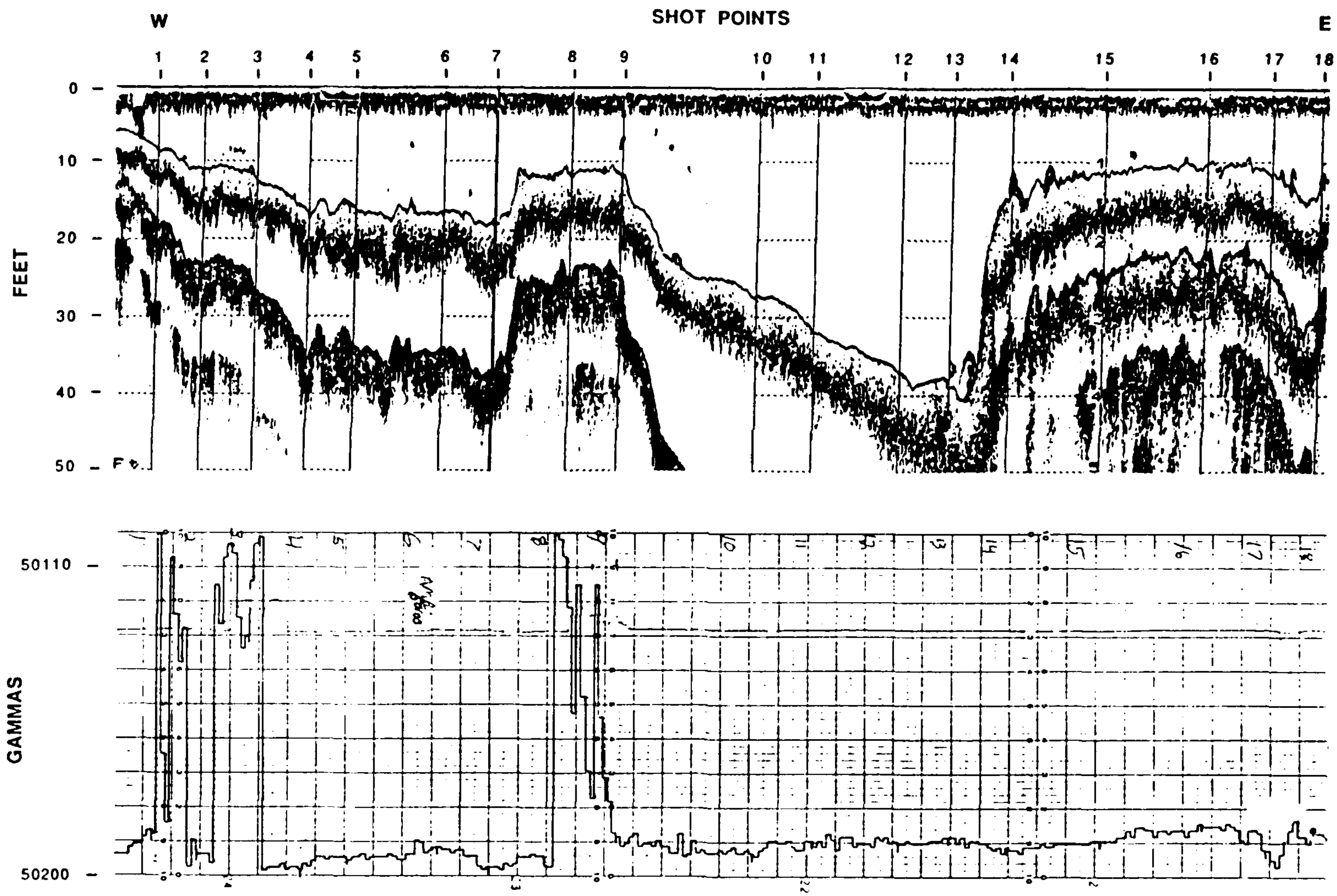

Figure 9. Correlative fathometer and magnetometer records, Line 24, Blue Point Chute Project Area.

the deep channel through the entire project area. This ridge, denoted by hatched lines in Figure 7, apparently represents dredged material derived from the deeper parts of the channel. Several anomalies were associated with this ridge (see Figure 7) and it is assumed that they represent debris which has accumulated along this feature through dredging. Support for this hypotheses is partially provided by a general lack of magnetic anomalies within the deeper portions of the channel itself. However, it is also true that in deeper water objects would be farther from the sensor and would be less likely to be detected, especially if they were small. Many of the other anomalies located in the shallow water on the western side of the channel are probably also related to modern debris. Several floats and poles for fishing lines and hoop nets are located in this area and fishing gear may be be responsible for much of the magnetics. Anomaly Number 4, while only 50 gammas in intensity, covered an area 360 by 160 feet (see Figure 7). Several fishing line floats were noted in the area of this anomaly, and it is possible that the source represents fishing gear.

Only one anomaly, Number 21, was recorded in the deeper waters of the main channel (see Table 2 and Figure 7). Anomaly Number 21, is quite large, both in area and intensity, and probably represents a fairly large ferrous source(s). Anomaly Number 17 produced the greatest magnetic deflection (180 gammas) of those recorded. This anomaly is located in about 10 feet of water near the eastern shore of the project area. Immediately adjacent to the bank in this area, were some wooden timbers and a piece of flat iron, possibly related to a water craft of some sort. However, as shown in Figure 7, no magnetics were recorded between Anomaly 17 and the bank and it is impossible to state whether or not the anomaly and the bank material are associated.

American Pass Project Area

Figure 10 presents information on the results of the magnetometer survey of the American Pass project area. As for the Blue Point Chute area, in this figure bathymetry is shown only for the Atchafalaya Main Channel area. Thirty three survey lines were run in this area and 12 magnetic anomalies of greater than 10 gamma intensity from ambient were recorded (Table 3). Four anomalies were selected in the field for additional examination and crossing transects were run over them. These were Anomaly Numbers 1,6,8, and 11 (Figure 10). None of the anomalies in the American Pass project area could be associated with identified sources.

Survey of this project area was hampered to some extent by a sand bar located in the mouth of American Pass and by very shallow water on the western side of the pass (Figure 10). It was impossible to operate the boat over portions of these shallow water areas.

As can be seen in Figure 10, a number of small anomalies are found inside the mouth of American Pass. The water in this area tended to be very shallow, ranging from 2 to about 8 feet deep, and it is probable that many of the anomalies here are related to small objects, possibly modern debris related to fishing activities. When this project area was first visited by the survey crew, a dredge was digging a channel across the project area and up American Pass to provide access for petroleum barges. The route of this channel is shown by the locations of the "Channel Marker Stakes" in Figure 10. Fathometer records collected during this study clearly showed the dredged channel and the associated spoil deposit on the western edge of the channel. As can be seen, one anomaly, Anomaly Number 11, is located immediately adjacent to the recently dredged channel in the area of spoil material. It is possible that this anomaly represents ferrous material dug by the dredge and deposited in the spoil, or material lost or discarded from the dredge boat during its operations.

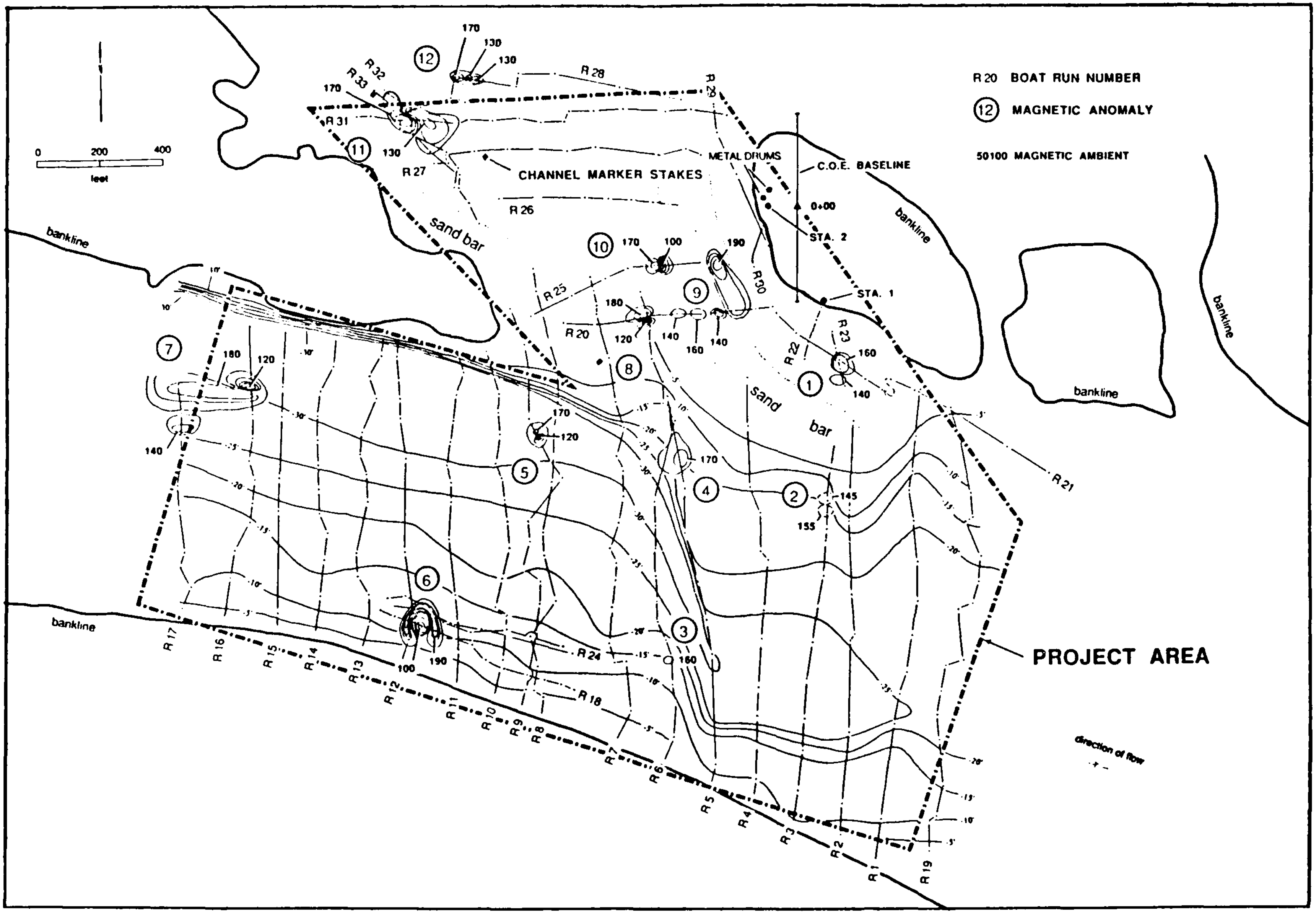

Figure 10. Survey and magnetic data, American Pass Project Area.

Table 3. Magnetic Anomaly Information, American Pass Project Area.

Anomaly No.	Deflection (Gammas)	* Character	Length (ft)	Width (ft)	Water Depth (ft)	Location		** Recommended Treatment
						Line Number	Shot Point	
1	30	D	100	80	2	21;23	8;3-4	EX
2	10	D	75	-	15	3	3	N
3	10	M	25	-	12	6	4	N
4	20	M	130	130	30	5;6	1-2;11-12	N
5	50	C	80	-	31	8	12-13	N
6	80	D	140	130	10	12;18	1-3;9-11	EX
7	60	C	380	200	25-30	16;17	1-2;1-3	EX
8	60	D	100	60	5	6;20	17-18;3-4	N
9	60	C	230	100	2	20;25	5-9;5-6	EX
10	70	D	80	-	6	25	5-5.5	EX
11	50	D	250	150	6	28;31	1-2;12-14	EX
12	40	C	110	-	6	28	3-5	N

NOTES: * D = Dipole; M = Monopole; C = Complex

** N = No further work recommended; EX = Examine for source of magnetics if to be impacted by construction.

Figure 11 presents information on the proposed location of the training weir in relationship to magnetic anomalies. Three anomalies, Numbers 9, 10, and 11 fall in the near vicinity of the weir. Prior to the survey it was felt that the shallow sandbar area in the mouth of American Pass could reflect the location of buried shipwreck remains. Anomaly 9 falls on this feature, however, it is impossible to state the identity of the source on the basis of the magnetic signature alone.

Figure 12 presents fathometer and magnetometer records for Line 6 which are, generally, typical of all of the lines crossing the Atchafalaya Main Channel. Two anomalies were recorded on this line. These are Anomaly Number 3, a small anomaly located at Shot Point 4 and Anomaly Number 8, a more intense anomaly located in the shallow waters at the mouth of American Pass. Of some interest is the fact that fathometer records in the main channel area showed no obvious evidence of dredging as did those in the Blue Point Chute area. A review of information on Corps of Engineers dredging operations in this region suggest that, in fact, this specific locale has never been dredged (Hans van Beek, Personal Communication 1988). Several anomalies are located in the deeper part of the channel (Anomaly Numbers 4, 5 and 7, Figure 10) and, if no dredging has ever occurred here, these could represent objects that have been in the channel for a considerable period of time. The American Pass area, also, lacks the numerous small anomalies in the shallow waters of the western side of the main channel found at Blue Point Chute. The reason for this is not totally understood, since fishing line floats and trotline poles seemed to be equally numerous in both areas. One large anomaly, Anomaly Number 6, was recorded in the shallow waters on the western side of the main channel (see Figure 10). Several trotline poles were projecting out of the water in this area and the source for the magnetics may be fishing gear.

Summary of Findings

The magnetometer surveys of the Blue Point Chute and American Pass project areas recorded a total of 34 magnetic anomalies having intensities of greater than 10 gammas. Only two of these anomalies could be related to identifiable sources, neither of which are significant historical resources. The geological history of the two projects indicates that, until recently, both lay within the shallow waters of Grand Lake. Information collected on the navigation history of the area indicates that both project areas fall near an important nineteenth and twentieth century water route across Grand Lake. The historical information does not indicate, however, that either of the project areas contained hazards to navigations which could contribute to vessel sinkings, nor were landing facilities, where boats could be both lost and abandoned, associated with either area. Information on shipwreck occurrences in the region indicates that several boats have been lost in and around Grand Lake (Pearson et al. 1987), however, none of these losses can be placed within the project areas. Taken together, the historical and geological information, suggests that there is a relatively low probability that shipwrecks have occurred in the two areas.

Most of the magnetic anomalies recorded in the two project areas are small in both intensity and area, and the presumption is that most are produced by modern fishing-related debris. While this is the presumption, it is emphasized that the sources for these anomalies cannot be identified with any degree of certainty. As noted above, large pieces of shipwrecks will produce relatively large and complex anomaly signatures. However, small fragments of boats, boat-related items such as anchors and chains, and, also, small boats can produce the types of anomalies recorded in the two project areas. In light of this fact, it is felt that an effort must be made to identify and verify the sources of a reasonable sample of the magnetic anomalies recorded during the study. Some of these anomalies fall within or very near the areas to be impacted by the proposed weir construction and their examination is considered a necessary element in the compliance procedure. Other anomalies selected for

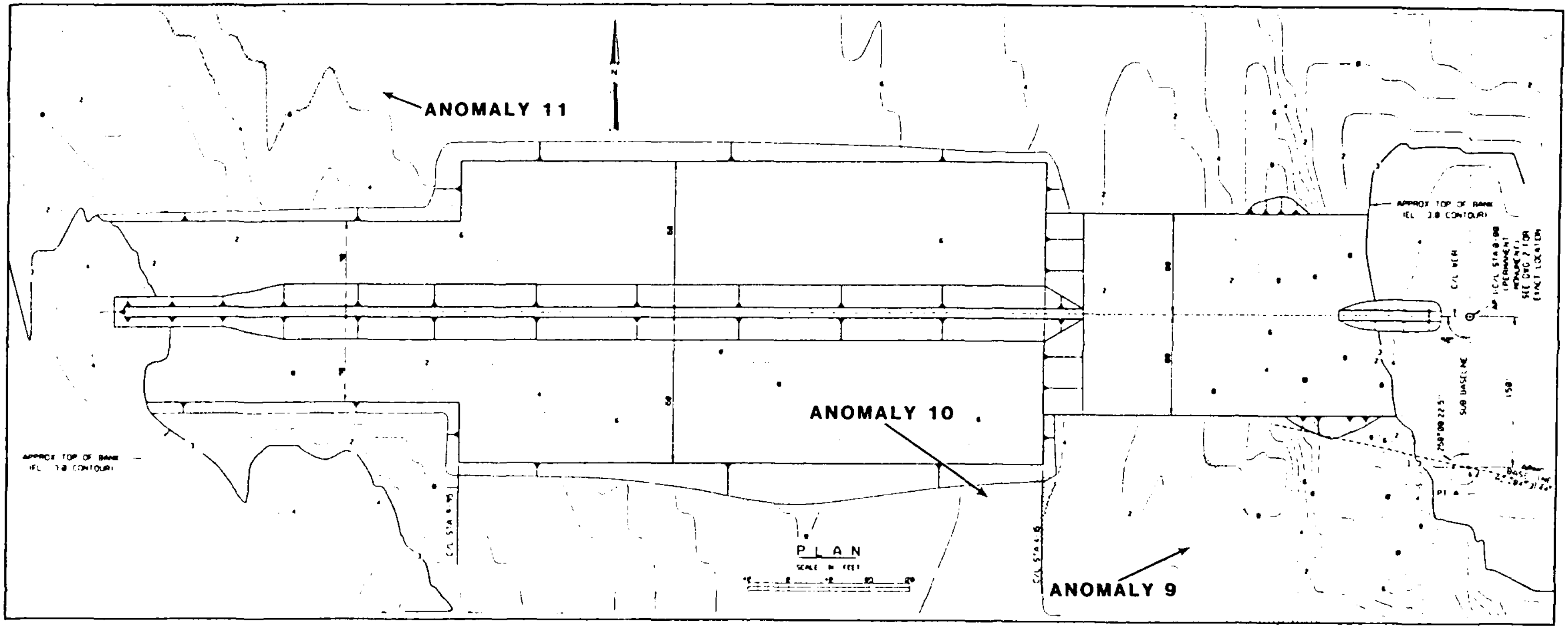

Figure 11. Proposed construction project and adjacent magnetic anomalies, American Pass Project Area.

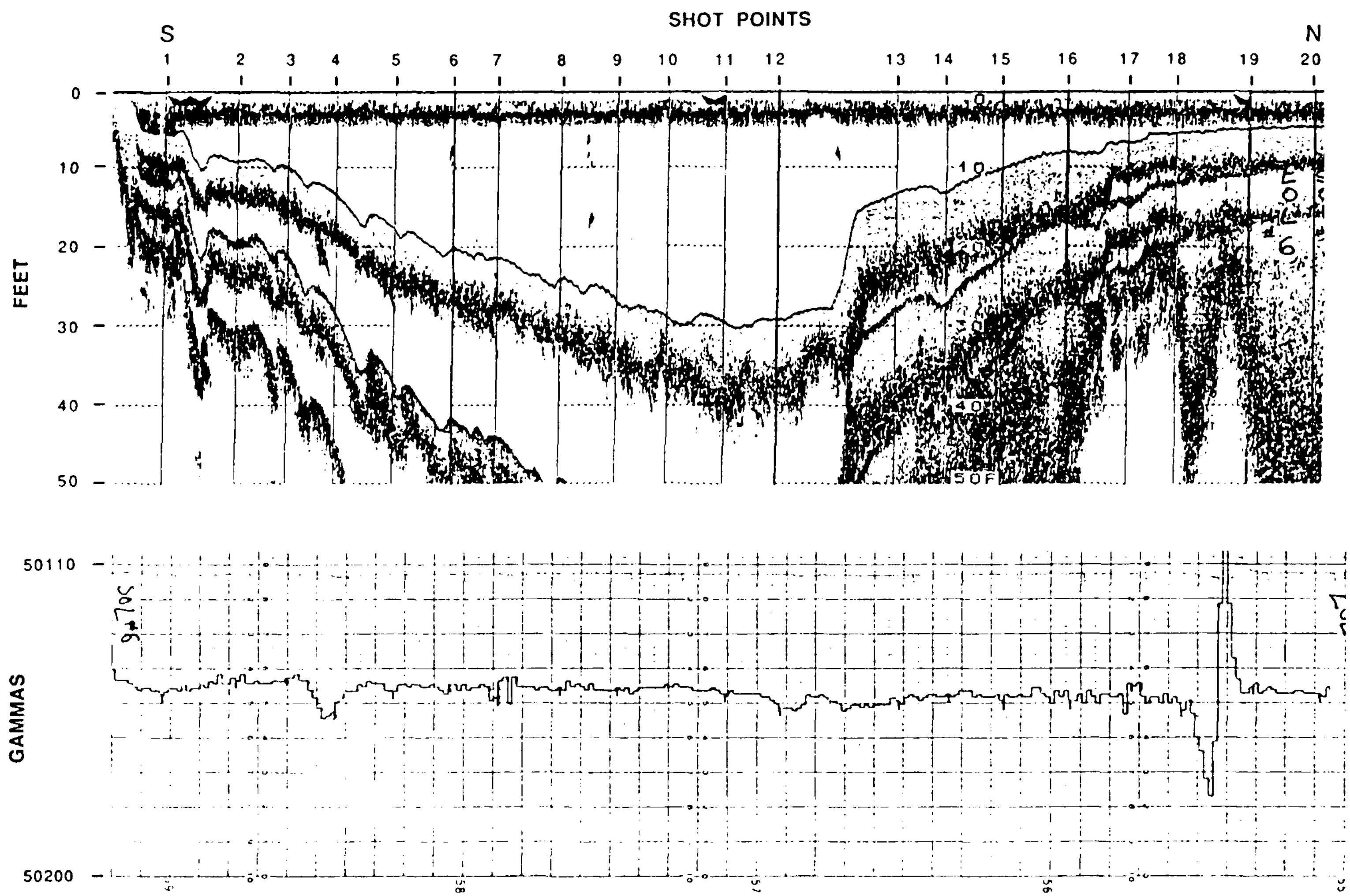

Figure 12. Correlative fathometer and magnetometer records, Line 6, American Pass Project Area.

examination fall within the Atchafalaya Main Channel area and will not be impacted in the near future. Their examination is considered necessary, however, as an initial step toward developing a systematic approach to the study of magnetic data and for establishing a usable set of criteria for evaluating and identifying magnetic data collected in the future. The alternative approach would be to physically examine all of the anomalies recorded during the survey. At present, this is considered inappropriate and the examination of a sample of anomaly sources a more reasonable approach.

Blue Point Chute Project Area

None of the anomalies recorded in the Blue Point Chute project area will be impacted by the proposed weir construction and, thus, none need immediate attention. Several anomalies in the Atchafalaya Main Channel area have been selected for future examination. These, shown in Table 2, consist of Anomaly Numbers 4, 5, 17 and 21. Anomalies 17 and 21 have been selected because they are similar in size and configuration to known shipwreck magnetic signatures. They are also located in a relatively deep portion of the channel and the sources may be of a fairly large size. Anomalies 4 and 5 are located, respectively, in the shallow water and what appears to be a submarine dredge-spoil ridge on the western side of the main channel. Examination of these anomalies in the future will provide information on the types of objects which do exist in these shallow water areas. As noted earlier, it is possible that the sources of these anomalies may be fishing-related objects. Even if this proves to be the case, it is important to gather that information, since it will begin to establish criteria for anomaly identification in other, similar areas.

American Pass Project Area

Three magnetic anomalies fall adjacent to the proposed weir location and they may be impacted by construction. These are Anomaly Numbers 9, 10 and 11 (see Figure 10). The sources of these anomalies are unknown and, prior to the initiation of construction, identification and evaluation of these sources is the recommended course of action. The diving operations conducted to evaluate these three anomalies are discussed in the following chapter. Three other anomalies in the project area have been selected for possible future examination, although, none of these will be impacted by the proposed weir construction. These three anomalies, however, provide a representative sample of the types of magnetic signatures recorded in the project area. These are Anomaly Numbers 1, 6 and 7 (see Figure 10 and Table 3). Anomaly 6 may be related to fishing gear or debris, however, physical examination is needed to verify this. Anomaly 7 is located in deep water and seems to be quite large in size. This anomaly exhibits characteristics of known shipwreck magnetics. Anomaly 1 is located in very shallow water just below the mouth of American Pass (see Figure 10).

CHAPTER 4: DIVING OPERATIONS

Introduction

In November 1988 a report detailing the conduct, results and recommendations resulting from the remote sensing survey of the two project areas was submitted to the New Orleans District, U.S. Army Corps of Engineers. Following the recommendations presented above, the Corps of Engineers requested that diving be conducted at the American Pass project area in order to locate, identify and evaluate the sources of Anomaly Numbers 9, 10 and 11.

Field investigations of the three anomaly locations were conducted from December 11 through 14, 1988. The crew consisted of four persons in compliance with Corps of Engineers regulations concerning diving operations. These individuals included the Project Director/Diver (Allen Saltus); Dive Supervisor (Thurston Hahn); Back-up Diver (Arthur Maxey), and Dive Tender (Laura McMurray). The dive vessel used was a 21 foot, aluminum boat powered by a 50 horsepower outboard motor. A surface-supplied air system was used, with air provided by a bank of two, high-pressure tanks carried in the dive boat. The dive mask used was a Kirby-Morgan bandmask that provided radio communication between the diver and the dive vessel. A complete set of SCUBA gear was maintained on the dive vessel as an emergency back-up system. Dive logs and other appropriate records were maintained during the diving operations. A Corps of Engineers safety inspector visited the site and examined and approved the diving operations on December 13, 1988.

The initial phase of the investigations involved the relocation of the three anomalies. This was accomplished by running several traverses over the anomaly locations with a magnetometer in order to locate and specifically delineate the magnetic center or focus of each locale. These points were then buoyed, and, later, the positions of the buoys were recorded using a Hewlett/Packard 3810 Total Station positioning system. The locations of the buoys were tied to survey points established in the area by the Corps of Engineers. The second phase of investigation involved the physical examination of each of the anomaly locations. The results of these investigations are discussed below.

Results

Anomaly Number 11

Anomaly Number 11 was located near the northwestern corner of the project area (Figure 13). The magnetic survey conducted to redefine the location of the anomaly indicated that the magnetic focus lay outside of the planned location of the weir, but possibly in an area that will be impacted by peripheral construction activities (Figure 13). During the original survey this anomaly was recorded as a dipole signature with a maximum magnetic intensity of 50 gammas and covering an area of 250 by 150 feet. At the time of the original survey the water depth at the anomaly location was about 6 feet, however, by the time of the present study the water had risen and this depth was close to 8 feet. The anomaly was located adjacent to the narrow channel that was being dredged at the time of the initial study, and it was felt that the anomaly could represent material that had been dug and redeposited by the dredging or which had been lost or discarded from the dredge barge.

Examination of this anomaly location began with the diver conducting an intensive search of the river bottom. There was zero visibility on the bottom during this search such that the examination had to be conducted by hand. In order to insure complete coverage, the diver conducted the search via a series of sweeps across the entire area covered by the magnetic

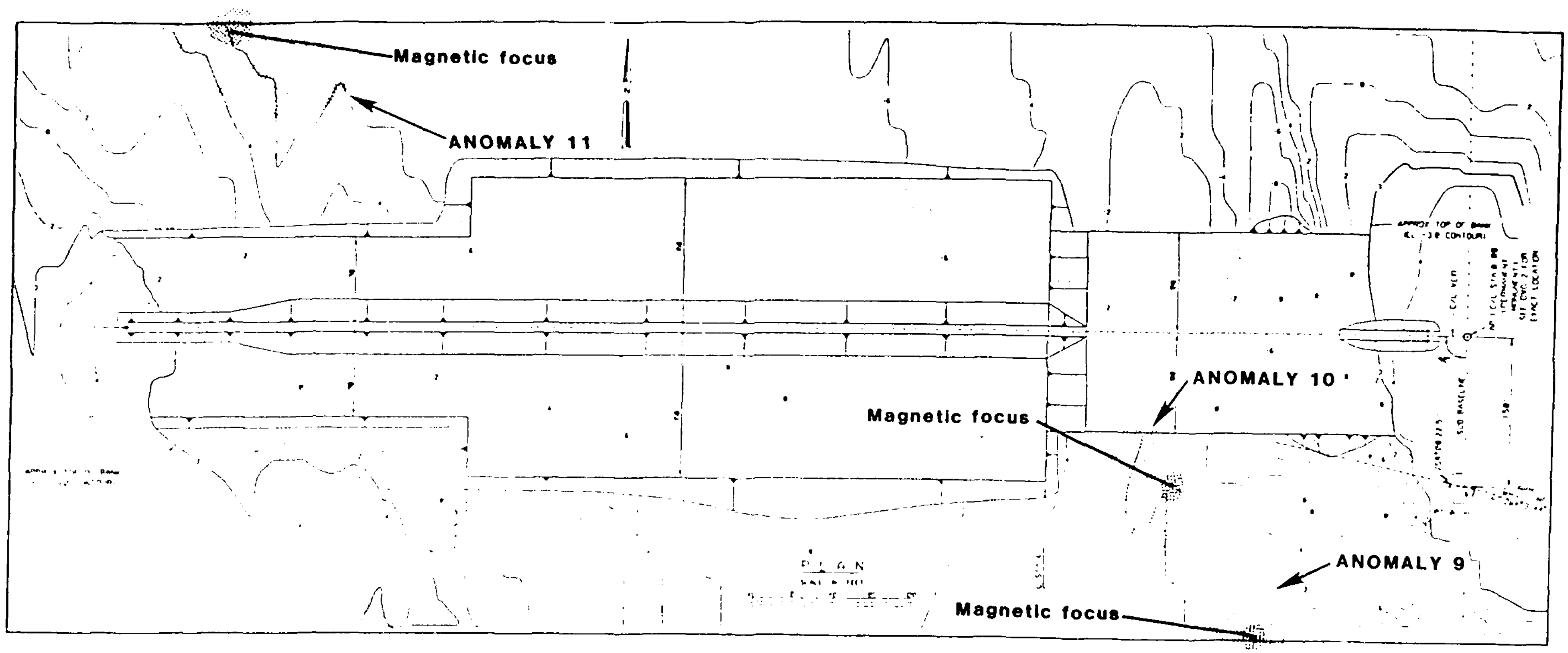

Figure 13. Construction plans for the proposed weir at American Pass and the redefined positions of Anomalies 9, 10 and 11.

signature directed by radio communication from the dive boat. This procedure was then supplemented by dragging a standard garden rake across the bottom in an effort to find objects that may have been missed by the hand examination. The bottom sediments at this locale consisted of a very loosely consolidated silt into which the diver sank to his knees; making the bottom search difficult, though not impossible. Nothing was found during this examination.

Additional investigation of this location involved probing into the bottom sediments with a 2-foot-long and a 6-foot-long probe. Using the shorter probe, the diver probed at approximately 2-foot intervals over the area covered by the anomaly. The longer probe was used to examine the focal point of the anomaly, where the source object was considered most likely to be. The bottom was so soft that the diver could easily extend the 6 foot probe plus his entire arm into the sediments, reaching a depth of about 9 feet. No cultural remains were found during the probing.

It appears that the source object for Anomaly 11 is either deeply buried, greater than 9 feet or so beneath the current river bottom, or the source consists of small, buried objects which are difficult to locate by probing. For example, the source may be a piece of iron cable or wire buried by several feet of sediment. An object of this type would be too deep to find through hand examination and it would be difficult to strike with a probe. No effort was made to remove the sediment at this locale because it was apparent that the source object(s) was too deeply buried to permit its safe examination with the equipment available. It is possible that the loose sediments found here consist, in part, of material derived from the recent dredging, since the dredged channel runs immediately adjacent to the anomaly location.

Anomaly Numbers 9 and 10

At the time of the original survey, Anomaly Number 9 was recorded in about 2 feet of water on a sandbar in the mouth of American Pass and Anomaly Number 10 was located on the edge of the sandbar in about 6 feet of water (see Table 3). The shallow water had prevented complete survey coverage of the sandbar and these two anomalies during the first study. The water was several feet higher during the present survey and complete coverage and delineation of these two anomalies was obtained when the area was resurveyed with the magnetometer preparatory to diving. The survey revealed that the two anomaly signatures merged, forming a single large magnetic feature (Figure 13). The two newly-defined foci of this anomaly both lay in about 5 feet of water.

Examination of these two anomalies followed the same procedures used on Anomaly Number 11. The diver initially examined the river bottom in the area covered by the magnetic signature by hand and, subsequently, dragged a garden rake across this area. Visibility at the bottom in this location was only about 3 inches, however, because of the shallow water, much of the work could be conducted without diving. Particular attention was directed at the examination of several irregularities found on the river bottom. The examinations indicated that the bottom sediments in this area consisted of soft sand and silt. Nothing was found during this phase of the investigations.

In the second phase of the investigation, a systematic subsurface examination of the entire anomaly area was conducted by probing with a galvanized pipe that was 10 feet long and 1 inch in diameter. Probes were placed at 2-foot intervals along transects spaced 3 feet apart, and over most of the area the probe could be extended to a depth of 6 to 7 feet. More closely-spaced probing was conducted where irregularities were found on the river bottom. The probing indicated that the bottom sediments consisted of alternating layers of sand and silt. While these sediments were similar in the areas of the two anomaly foci, there were

slight differences. There appeared to be only two prominent sand layers in the area of Anomaly 10; one located at depth of 10 inches below the surface and one at 4 feet below the surface. The bottom sediments in the area of Anomaly 9 seemed to consist of numerous, thin layers of sand and silt. No cultural remains were found during the probing. As at Anomaly Number 11, the source objects may be deeply buried or consist of small, shallowly buried items that are difficult to locate through probing.

A water pump was taken in the field to be used to jet sediment out of the way if it was found that the source object(s) were not deeply buried. The presumed depth of burial of the sources for all three of the anomalies examined prohibited the feasibility of using the pump/jet system. Additionally, the loose sediments found at all three locations would have made the deep excavations required difficult as well as dangerous.

Replotting of the locations of the focal points for these two anomalies revealed that both lay outside of the area of the proposed weir as indicated on Corps of Engineers construction plans (Figure 13).

Conclusions

None of the sources producing the three magnetic anomalies examined were found. The closely spaced probing at all locations would have contacted any large object, such as an articulated fragment of a boat, if it lay less than 6 feet or so beneath the river bottom. If the sources do, in fact, consist of large objects, then they are deeply buried and will be difficult to locate and identify without a considerable expenditure of time and effort. The possibility does exist that the sources for all three anomalies consist of a cluster of small objects buried at shallow depths or linear objects such as wire or cable that were missed by the probing. If this is the case, it is highly probable that these objects consist of debris related to activities such as fishing, boating, or dredging. In this event, it is unlikely that the source objects would represent significant cultural remains. This is particularly true for Anomaly Number 11, whose source may be related to the dredging recently conducted at this locale. Additionally, plotting of the anomaly locations indicates that the focal points for all three are located outside of the boundaries of the planned weir.

It is recommended that no additional effort be expended to examine these three anomalies. However, the construction personnel should be made aware that these anomalies exist and may be impacted if excavations at these locales extends to depths greater than 6 feet. If so, they should visually observe the dredged material to see if the source objects are being removed.

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